

reclaiming the lake: ecological infrastructure as a catalyst for change



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master's project

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project definition

Project Title:

My project is public transportation and intermodal nodes as ecological infrastructure.

Elevator Statement:

My project is about reclaiming Lake Calumet and the Calumet River. In addition, my project revolves around the brownfield sites located on and around Lake Calumet and the Calumet River in order to educate the community about the importance and significance of these natural resources in the development of the city of Chicago. This project will not only address the environmental and ecological infrastructure issues of the area, but create exhibit space to demonstrate the history of the area, its current status, and the future in order to be an adaptable space that can grow and evolve in the future.

Case Statement:

Since the 1890's, Lake Calumet has changed drastically. This industrial zone within the city of Chicago has seen both the large booms and declines in the economy. Lake Calumet is the largest intermodal commercial The vast amount of contaminated land is detrimental to not only the environment, but the local economy as well. The purpose of this project is to return the land to its natural site while at the same time reengaging the community with the natural resources that surround them. The need for water reclamation and ecological education has a lot of potential in this area and that is the ultimate goal of this project.

Process Explanation:

To develop my project, I will first obtain information regarding the existing infrastructure and study how that infrastructure can be amended in order to benefit the local economy and community. There is a need to create new public transportation systems in the Lake Calumet area that would be a catalyst for social, economic, and ecological change. By creating ecological infrastructure the permeability of this urban area can be successfully changed as the remediation process of this post-industrial landscape begins to return to a more natural landscape of wetlands and marsh. The form and flow of the lake itself might also change over time to once again replenish Lake Michigan.

goals & guiding principles

goals

- the integration and layering of various modes of transportations to reduce the amount of hardscape, cars, and need for fossil fuels
- to restore the post-industrial landscape into a wetlands preserve that enables pedestrian traffic and bicycles to enjoy the landscape as they commute between the various nodes
- to transform the post-industrial landscape in such a way that it enhances the surrounding community and acts as a catalyst for change in the area

guiding principles

- to enhance the infrastructure of the Lake Calumet area
- increase the permeability of the post-industrial landscape
- using public transportation as a catalyst for change economically, environmentally and socially
- provide open space for the surrounding communities to enjoy the lake and its wonders
- integrate post-industrial waste into an ecologically conscious project
- to return the lake to a more natural state

stakeholders

the lead entities in this project will be the city of chicago, the e.p.a., and the design team. the e.p.a. is a key leader in this project due to the fact that 11 of the 33 superfund sites are within 1.3 miles of lake calumet. these sites contain high concentrations of various pollutants that are leeching into the ground and then into the aquafir.

the indirect stakeholders have an interest in these intermodal nodes because the aim of these nodes is to not only create public transportation, but also serve to educate people on the ecology, purpose, and importance of wetlands. in addition, the structures themselves will serve by "purifying" or "recycling" centers in that they will actively clean the site and can recycle certain industrial waste products.

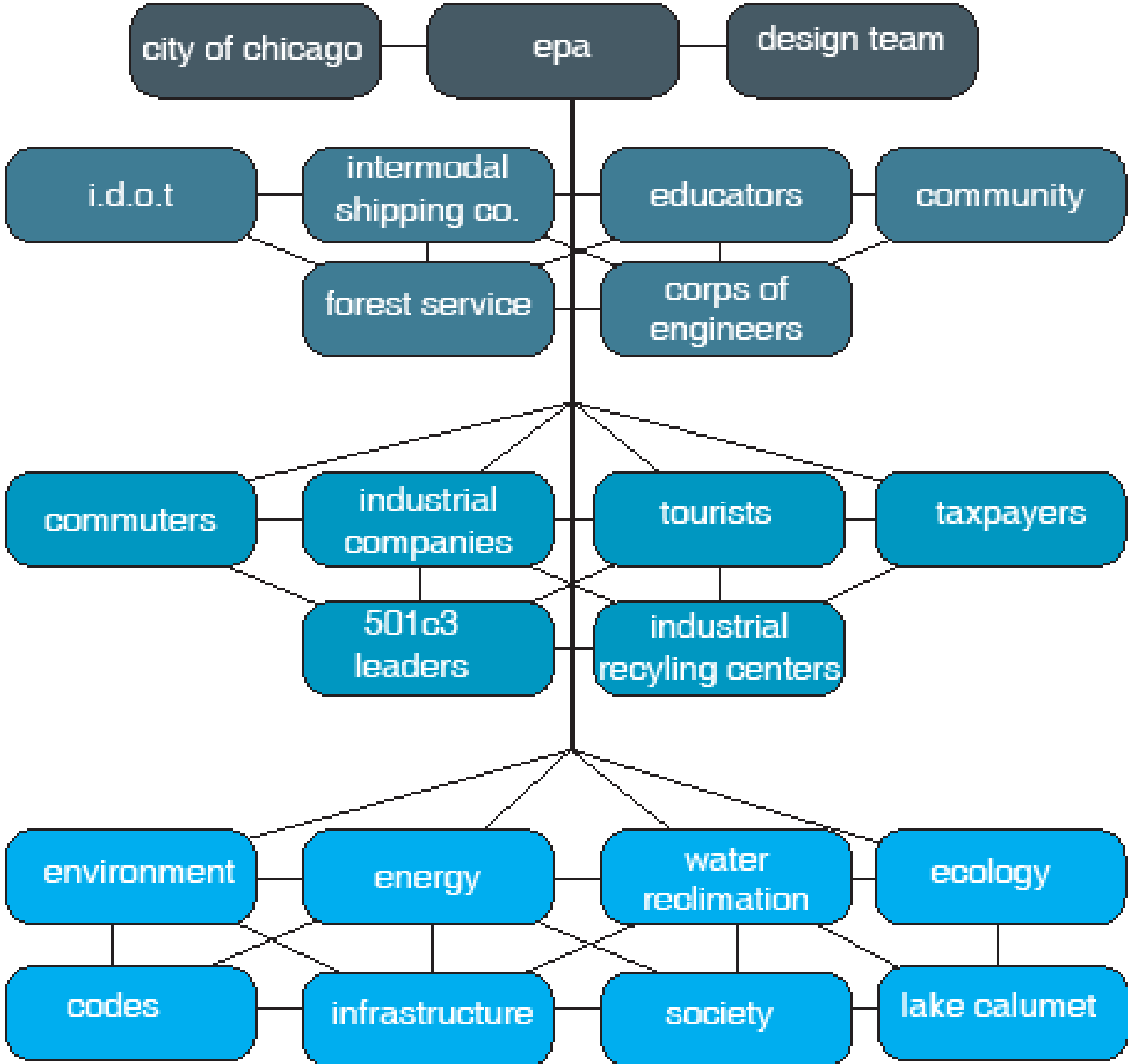
the general stakeholders is really the environment and society as a whole. as the population continues to increase and fresh water resources around the globe decline, there must be an active approach to preserving and restoring these resources and properly manage them to help mitigate our impact on the environment in the future.

leadership

direct stakeholders

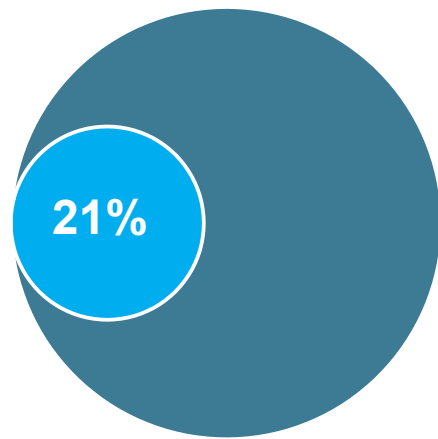
indirect stakeholders

general stakeholders

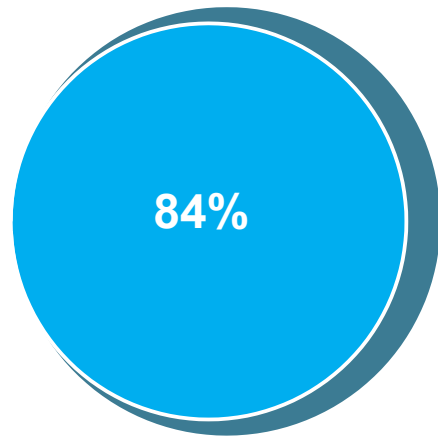


great lakes basin

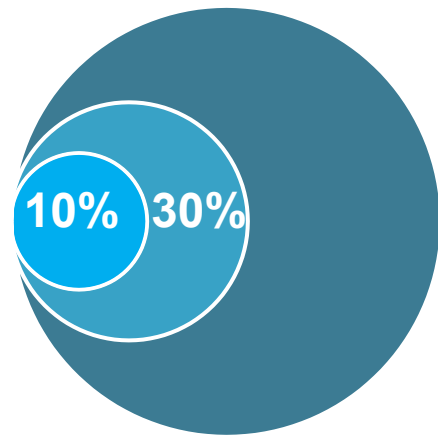
The great lakes basin is the largest resource in the world for fresh surface water. The great lakes hold approximately 5,432mi³ of fresh water, which accounts for 21% of the global surface fresh water supply. The great lakes are an invaluable natural resource that need to be protected and monitored in order to ensure the longevity of this resource.



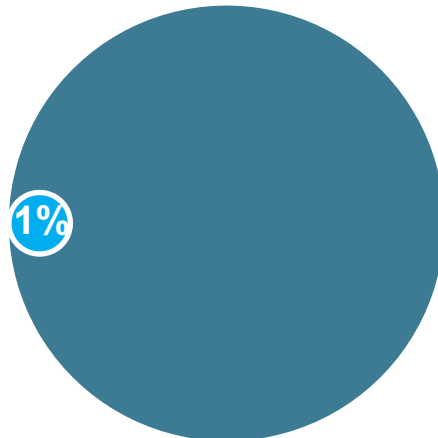
percentage of world's surface fresh water supply contained in the great lakes



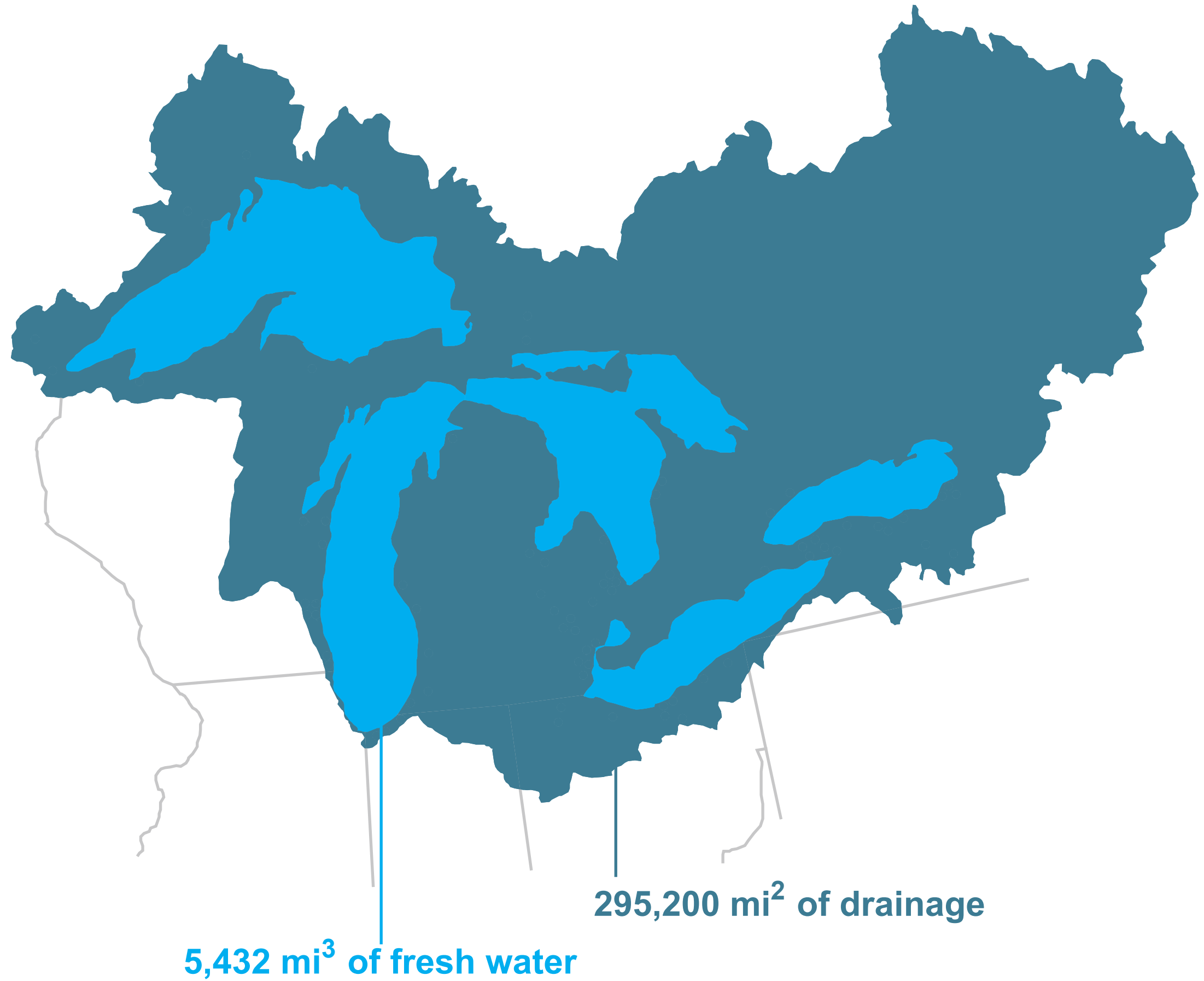
percentage of surface fresh water supply in north america contained in the great lakes



percentage of the population of the united states compared to canada that live in the great lakes basin



percentage of volume replaced each year



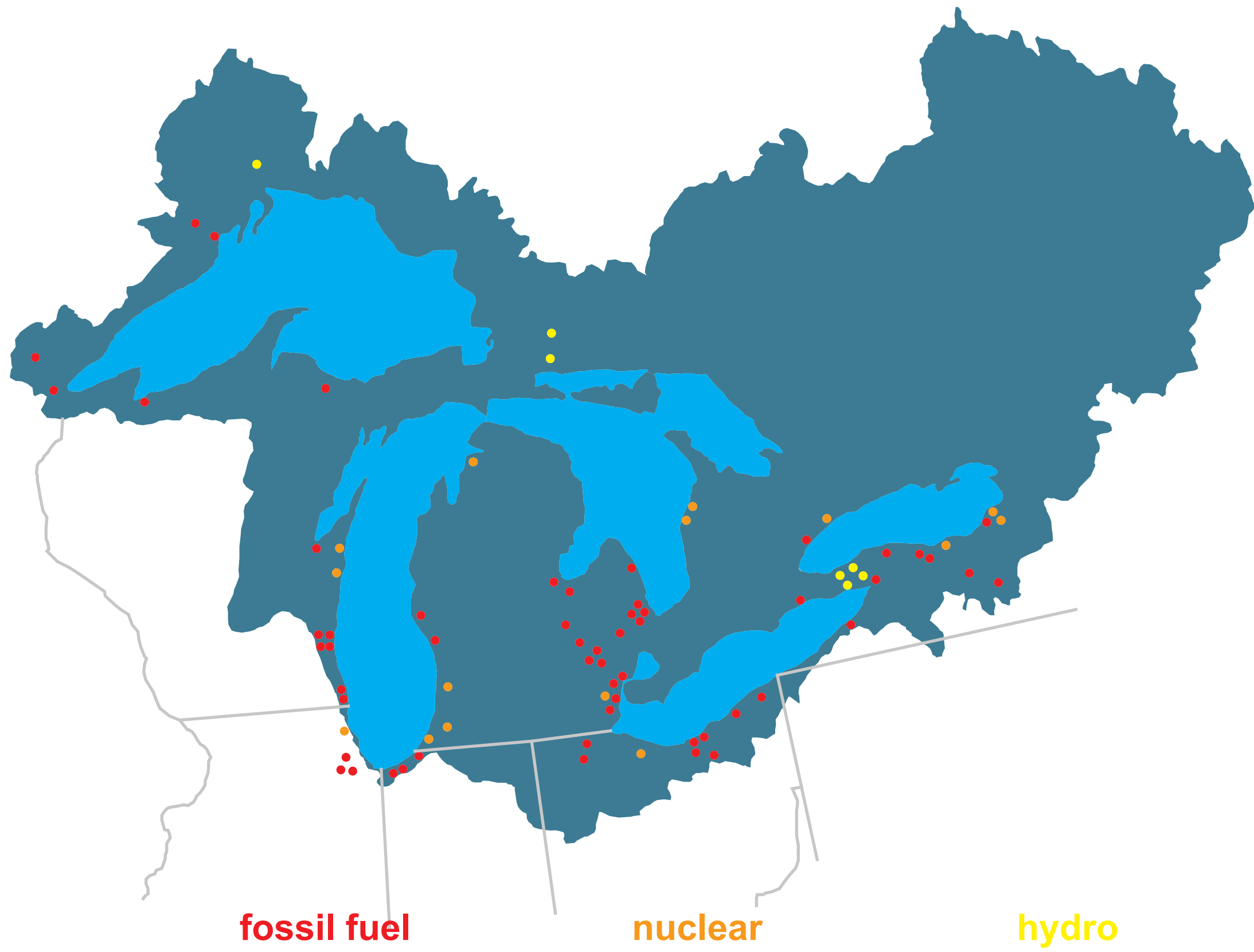
the average generating plant was built in 1964 using 1959 technology

fossil fuel generating plants are large contributors of CO2 into the earth's atmosphere

mercury is deposited into the lakes from fossil fuel generating plants

nuclear waste is often stored onsite at generating plants

nuclear and fossil fuel generating plants use huge amounts of water in the generating process; so much as to rival that used in agricultural and domestic uses in the great lakes basin



great lakes basin energy pollution

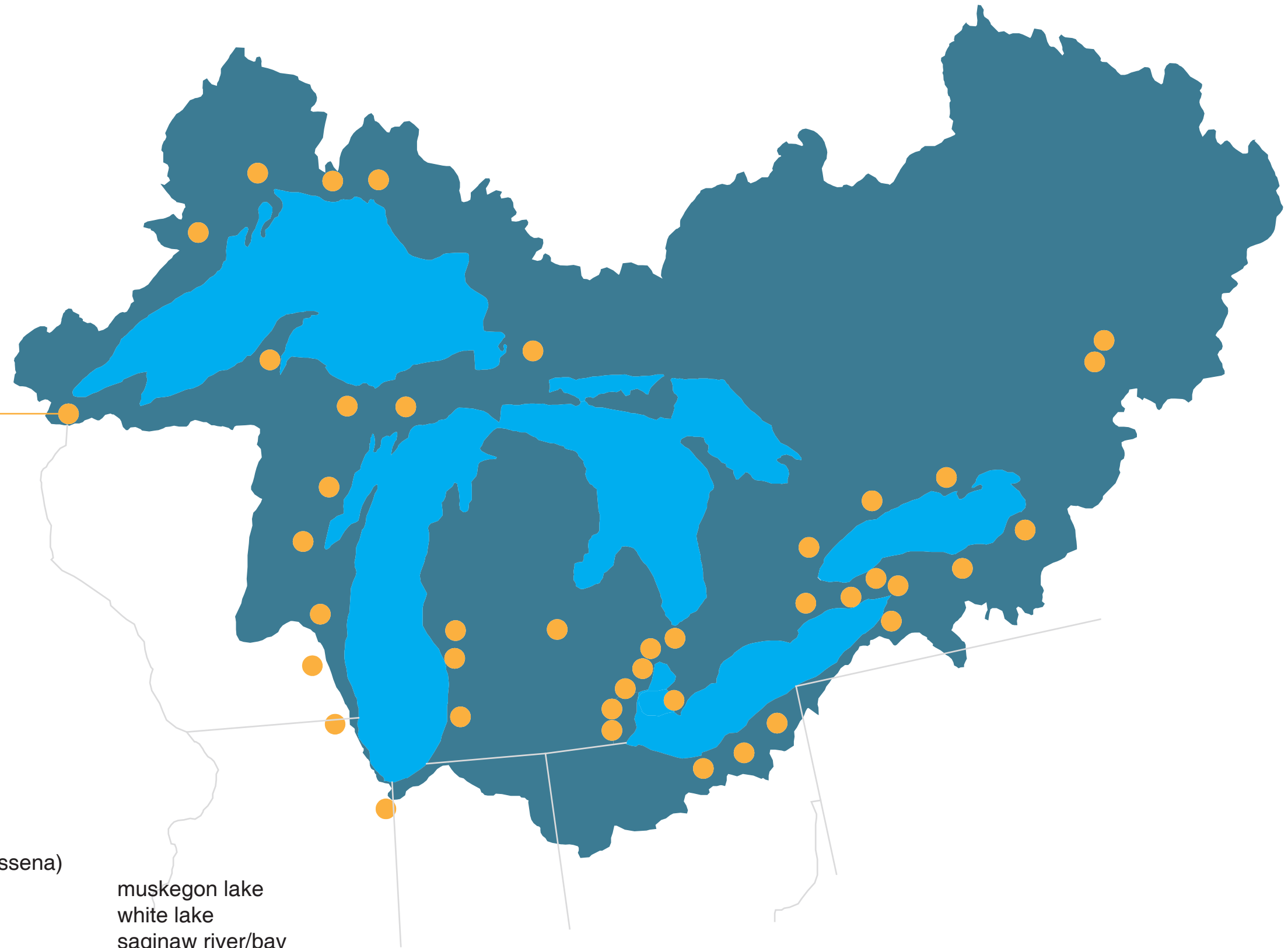
43 areas of concern

the great lakes areas of concern (AOCs) are environmentally degraded areas within the great lakes basin

thunder bay
 nipigon bay
 jackfish bay
 penninsula harbor
 st. mary's river
 st. clair river
 detroit river
 wheatley harbor
 niagara river (ontario)
 hamilton harbour
 toronto and region
 port hope
 bay of quinte
 st. lawrence river (cornwall)
 cuyahoga river

torch lake
 deer lake-carp river
 st. louis bay
 st. lawrence river (massena)
 manistique river
 menominee river
 fox river
 sheiboygan bay
 milwaukee estuary
 waukegan harbor
 grand calumet river
 kalamazoo river
 muskegon lake
 sheiboygan bay
 ashtabula river

muskegon lake
 white lake
 saginaw river/bay
 clinton river
 rouge river
 river raisin
 maumee river
 black river
 buffalo river
 niagara river (new york)
 eighteen mile creekl



great lakes basin
 areas of concern

**180+ invasive species
since 1840**

- 59 plants
- 18 mullusks
- 26 fish
- 21 crustaceans
- 19 phytoplankton
- 23 other invertebrates
- 7 algae
- 3 viruses
- 6 annelids

**great lakes basin
invasive species**



major cities that drain to the great lakes

- duluth
- green bay
- milwaukee
- michigan city
- detroit
- cleveland
- toronto
- bay city
- gary
- toledo
- buffalo

major city that does not drain to great lakes

chicago

this change in drainage is due to the dredging the calumet, grand calumet and little calumet rivers and the reversal of the chicago river

these changes altered the natural drainage of these waterways and directed them to the illinois river and then on to the mississippi river and down to the gulf of mexico

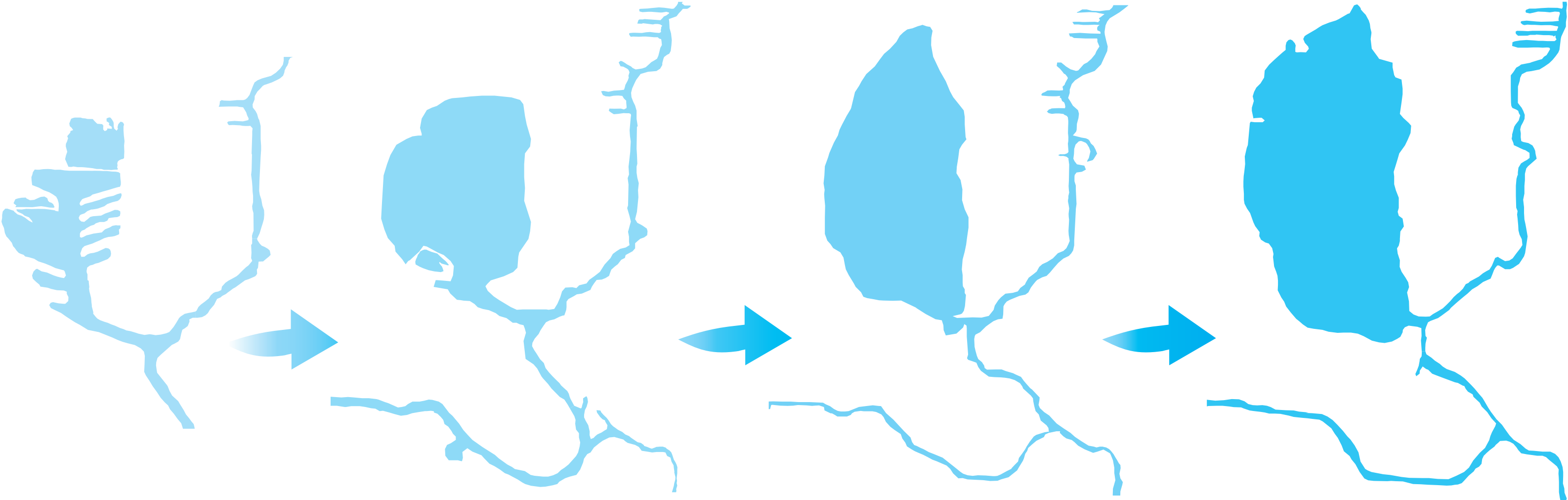


great lakes basin
urban runoff

catalyst for change

Public Transportation as a Catalyst for Change

By building on the existing, or non-existent, infrastructure in the Lake Calumet area will benefit the residents economically, socially, and environmentally. The creation of these new intermodal interchanges of public transportation will benefit the local economy by creating jobs and decreasing the resident's needs to purchase fuel for their cars. In addition, these nodes will benefit the residents socially and culturally by exhibiting historical information of this industrial area and also exhibit what this area can become as it is restored to natural wetlands. As you can see on the opposite page, Lake Calumet has changed size, shape, and depth dramatically over the last 100 years due to human interference. These changes occurred due to advances in technology and the need to allow larger vessels into the area to transport goods to and from overseas onto freight lines to transport them nationally. The Calumet area used to be a place for hunting, fishing, family gatherings, and bird watching. However, due to the dumping of toxic waste into the lake and surrounding area over the last 130 years the natural ecology has been significantly affected. In fact, 11 out of the Environmental Protection Agency's "superfund" sites are within 1.2 miles of the lake. Several remediation processes will be utilized to return the post-industrial landscape to restored wetlands and the intermodal nodes of transportation will be the catalyst that will enable this remediation process to succeed. The reason these nodes will enable the wetlands restoration to be successful is because these nodes will serve to engage and educate the public and hopefully inspire them to take action and acknowledge the impact we have had on the natural ecology of the area.



lake calumet history



1901

lake calumet had an maximum depth of 6'

between 1850-1900 9 different railroad companies had laid track in the area making it the largestest intermodal shipping center in north america

illegal waste dumping occuring



1930

lake calumet had an maximum depth of 8'

1926- little calumet river was straightened

1920s - drainage of the calumet area was reversed from lake michigan to the illinois river

lake calumet history



1960

lake calumet had a maximum depth of 28'

introduction of standard shipping container in 1956 changed the way goods were transported around the globe

lake calumet was dredged to accomodate these new ships the caused an industrial boom in the area

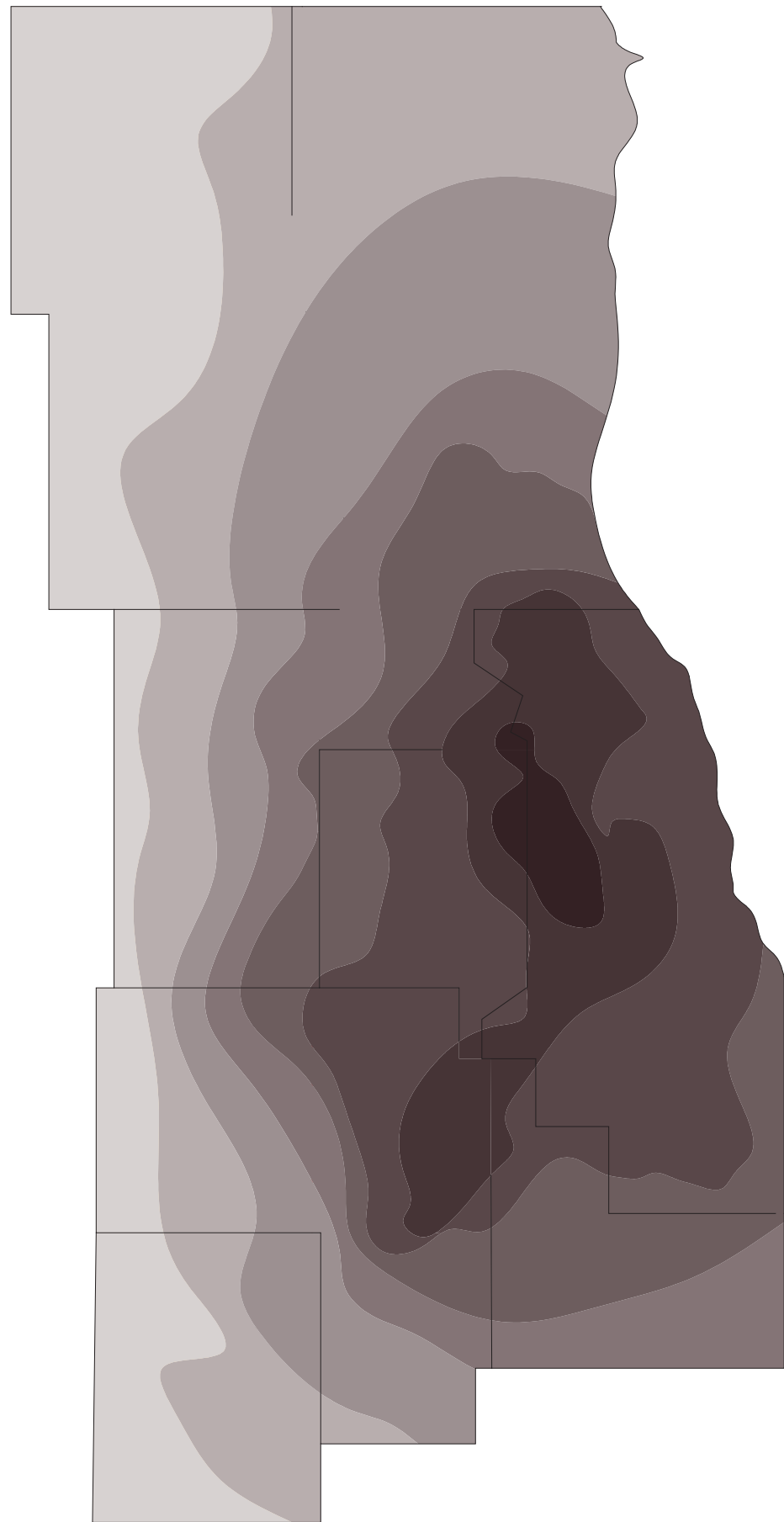


2000

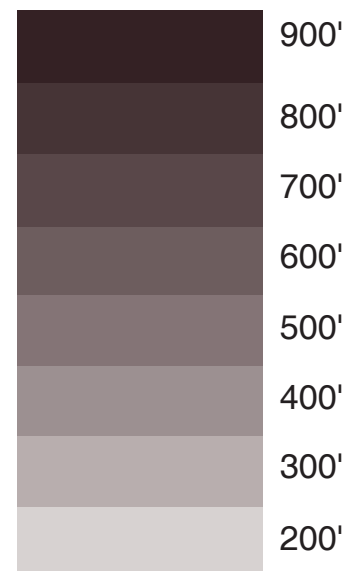
lake calumet had a maximum depth of 30'

dredged to permit larger ships into lake to intermodal shipping centers

1970-1980s steel industry bottoms out

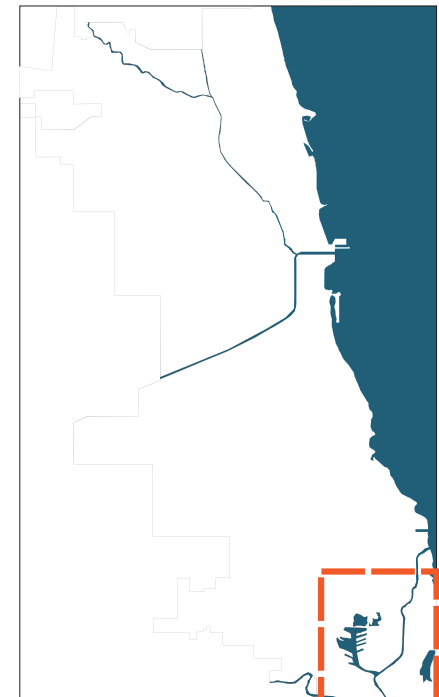
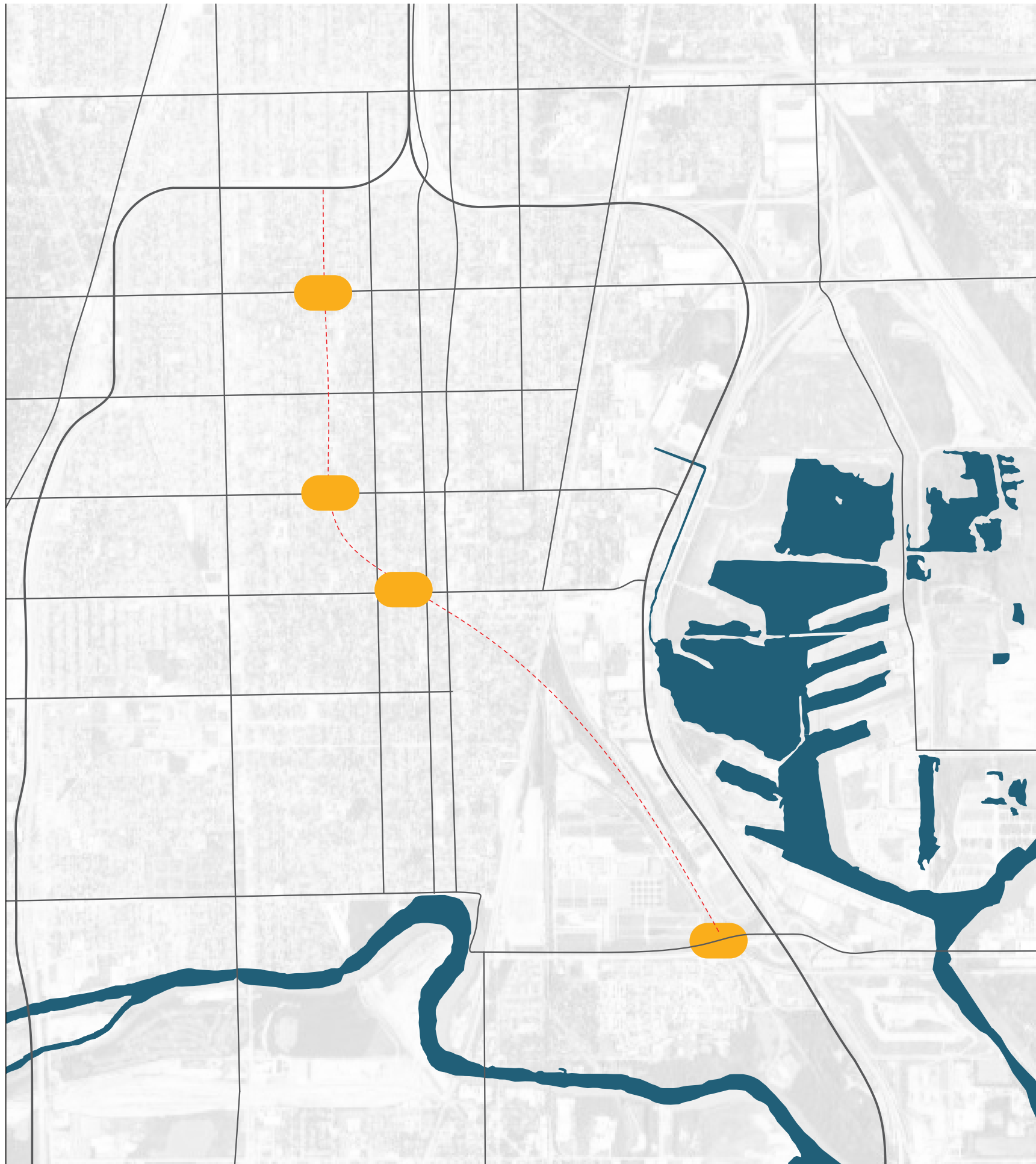


decline in ground water level in the Cambrian-Ordovician aquifer system between 1864-1980



ground water withdraw in chicago 1864-1980

Due to the reversal of the Chicago River, the Little Calumet River and the Calumet River, the ground water level in the Chicago area has significantly declined over the last 100+ years. The dredging of Lake Calumet and the reversal of natural hydrologic flows have resulted in declining lake and aquifer levels. These declines can be mitigated but action must be taken now. By creating constructed wetlands on brownfield sites and vacant lots, Chicago will be able to begin to return rain water back to the aquifer and begin to replenish this priceless resource.

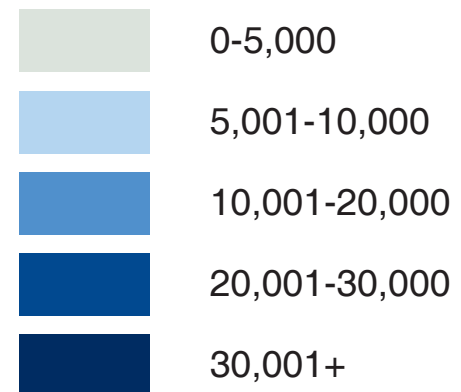
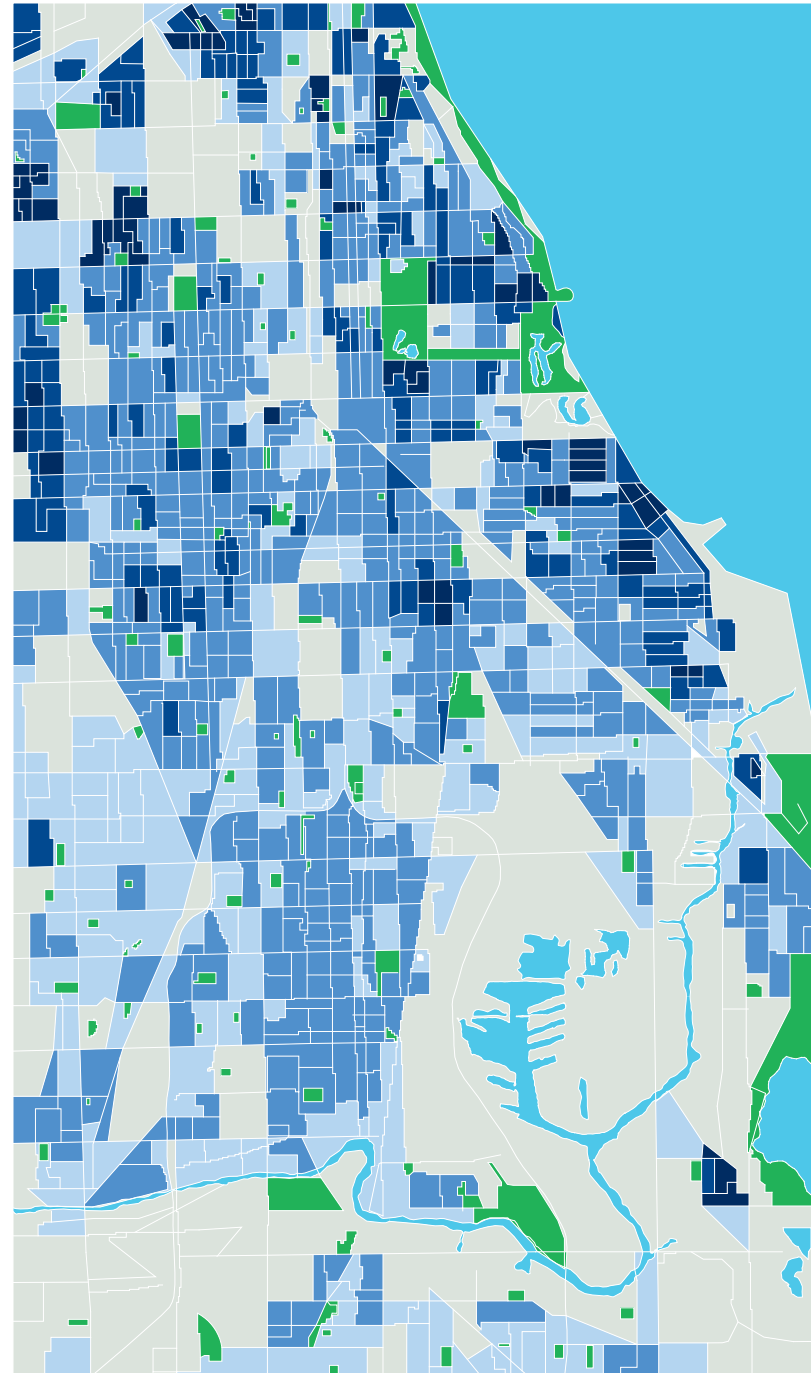


demographics

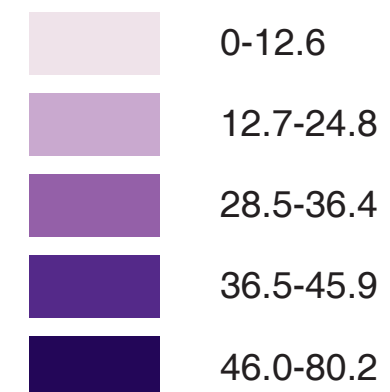
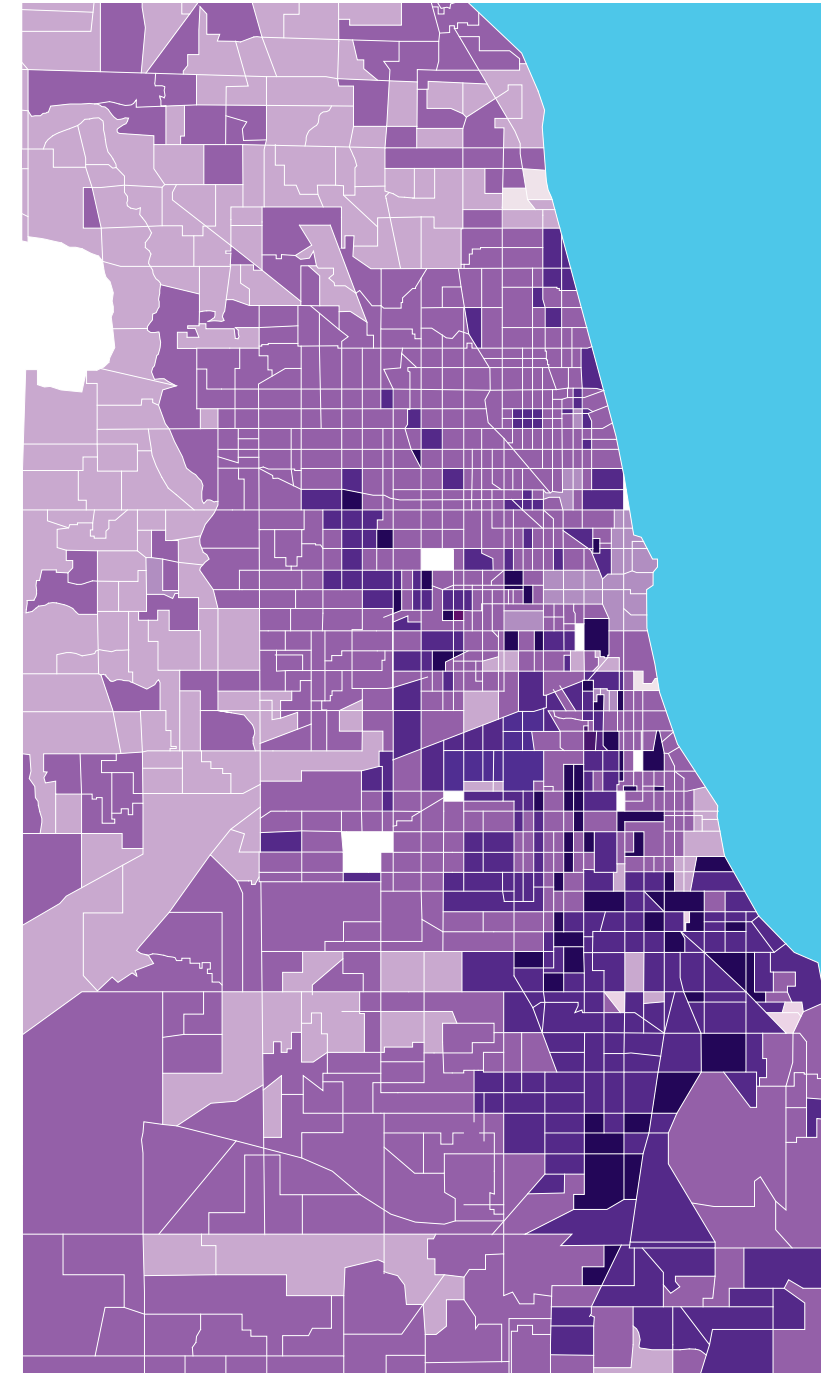
In order to identify the need for public transportation in the Lake Calumet area an analysis was done in order to identify the population density, poverty level, age diversity and density, and availability of a vehicle. This data clearly indicates that there is a need for the development of this ecological infrastructure.

The creation of this infrastructure aims to improve the area in several ways simultaneously. First, this new infrastructure will create jobs which will improve the local economy of the underserved communities of the area. Secondly, the introduction of new public transportation will reduce travel times for residents as well as the number of cars on the road. This will result in greater mobility for the residents as well as improve the air quality and the environment by reducing the number of cars on the road.

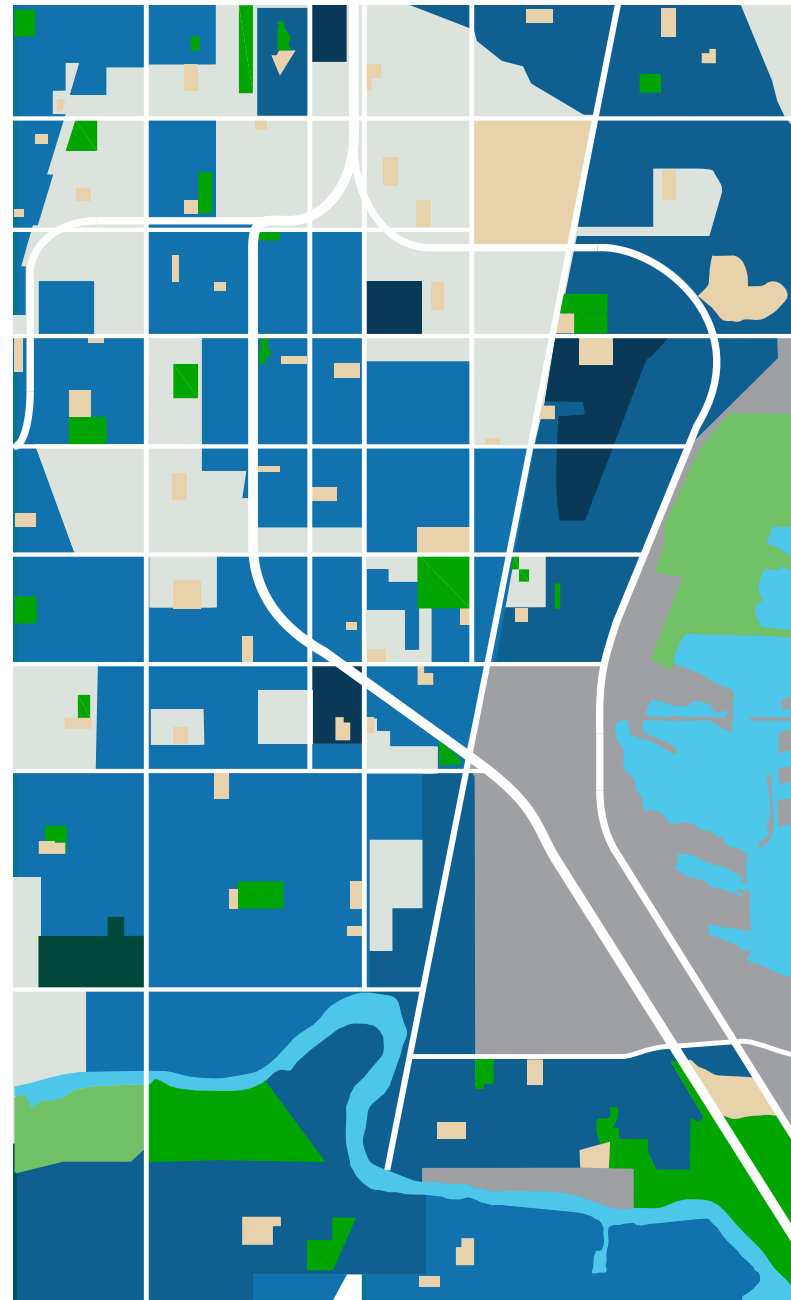
population density
(persons per square mile)



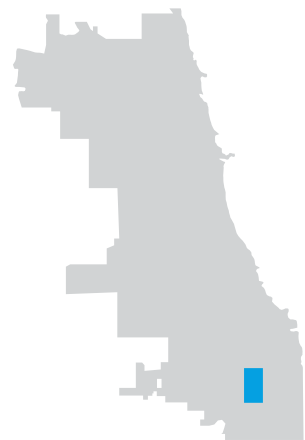
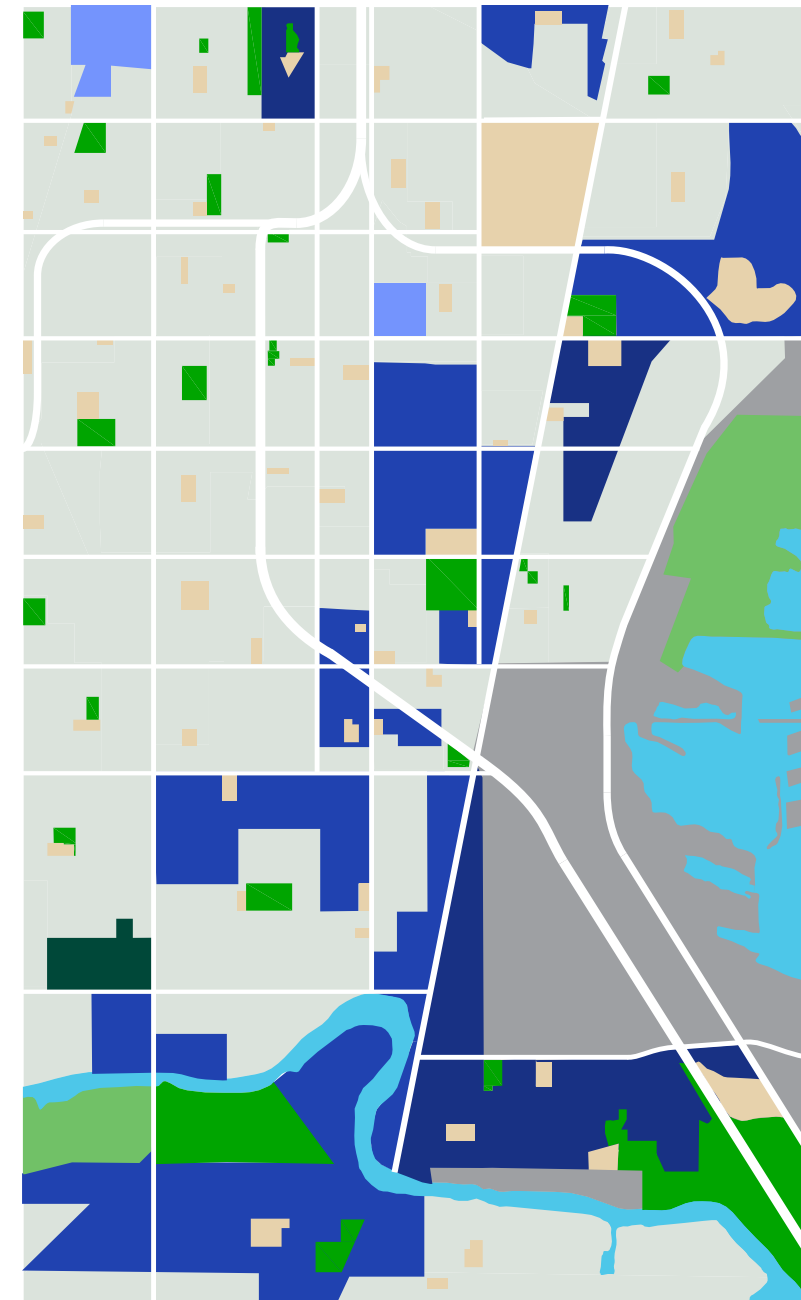
average commute time
(minutes)



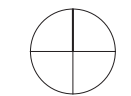
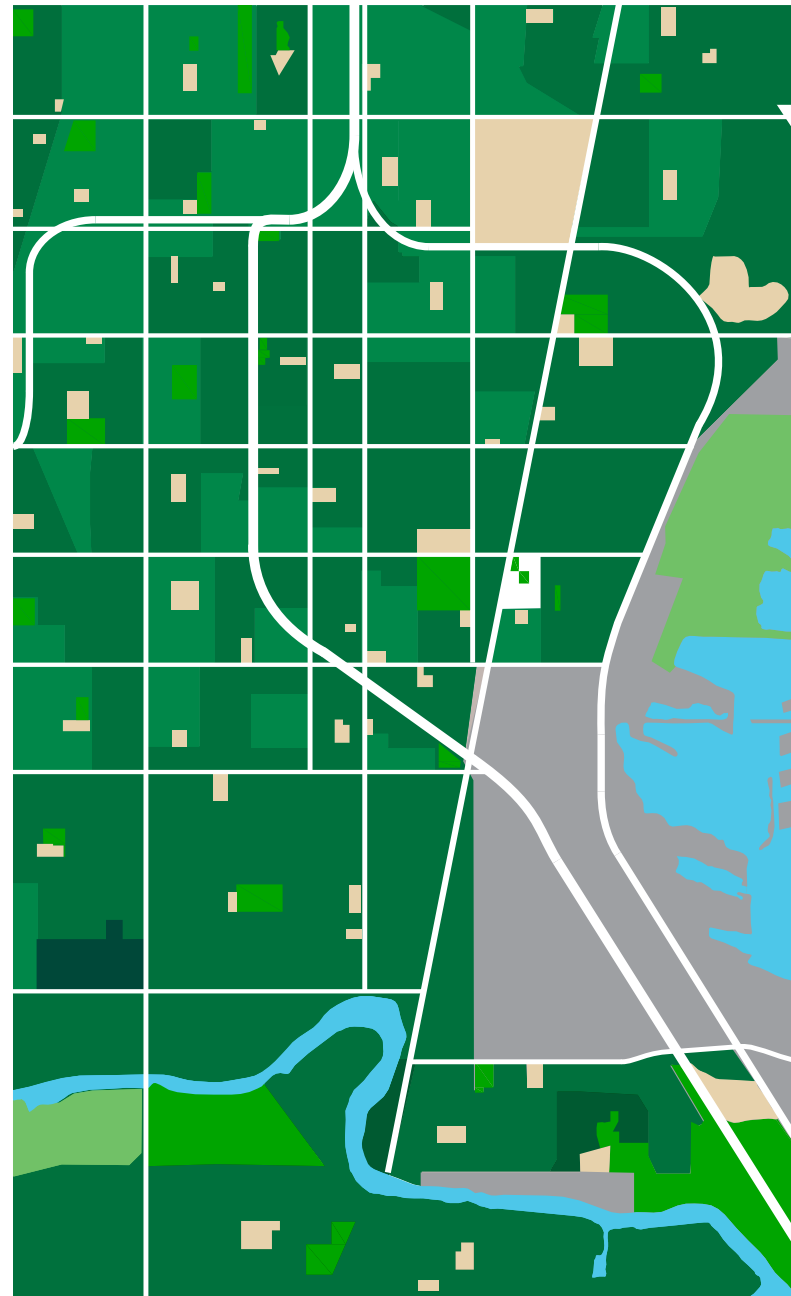
poverty status
(persons per square mile)



no vehicle available
(persons per square mile)

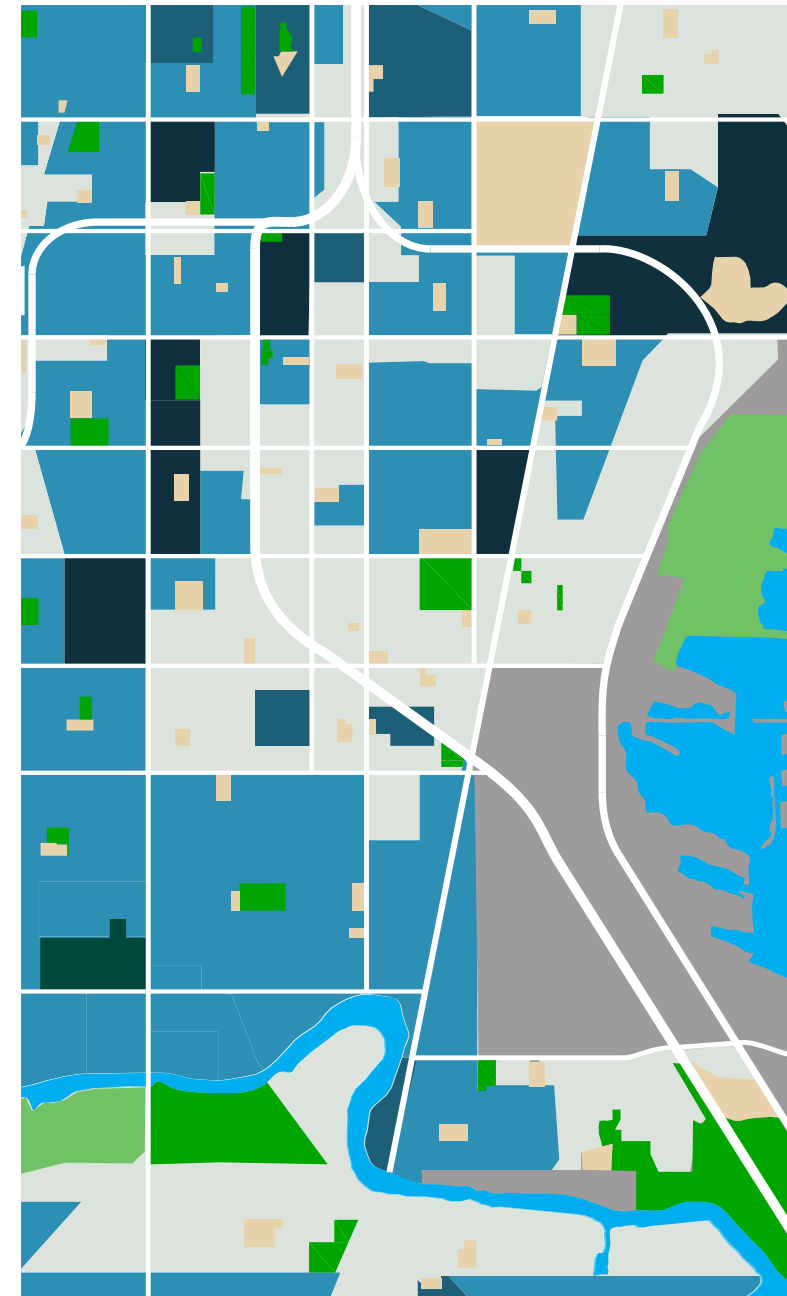


under 18
(persons per square mile)

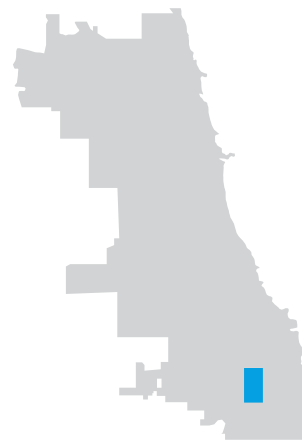


0 0.25 0.5
Miles

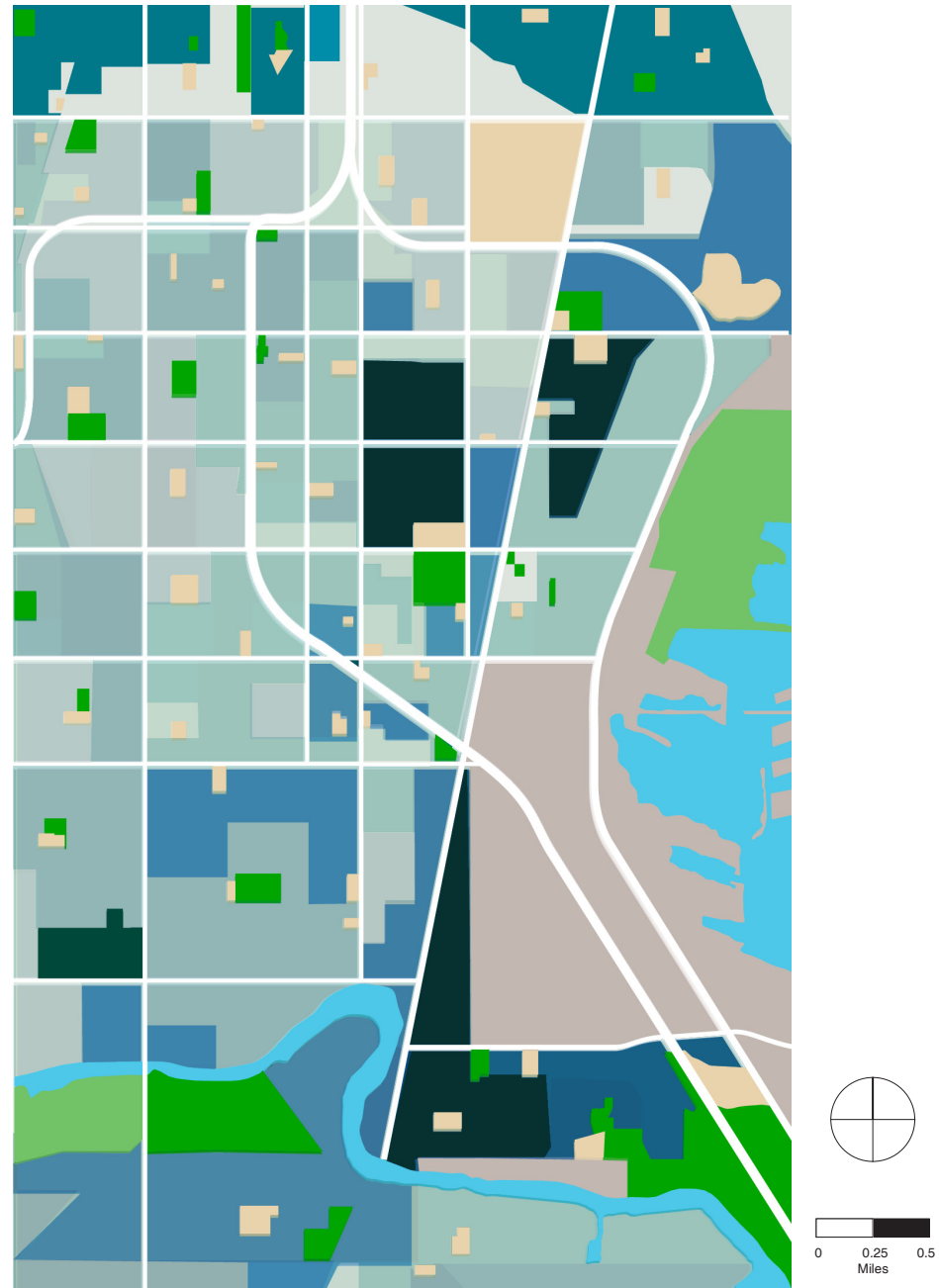
over 65
(persons per square mile)



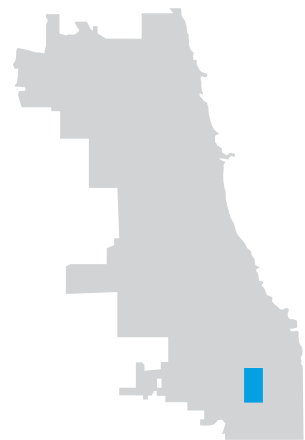
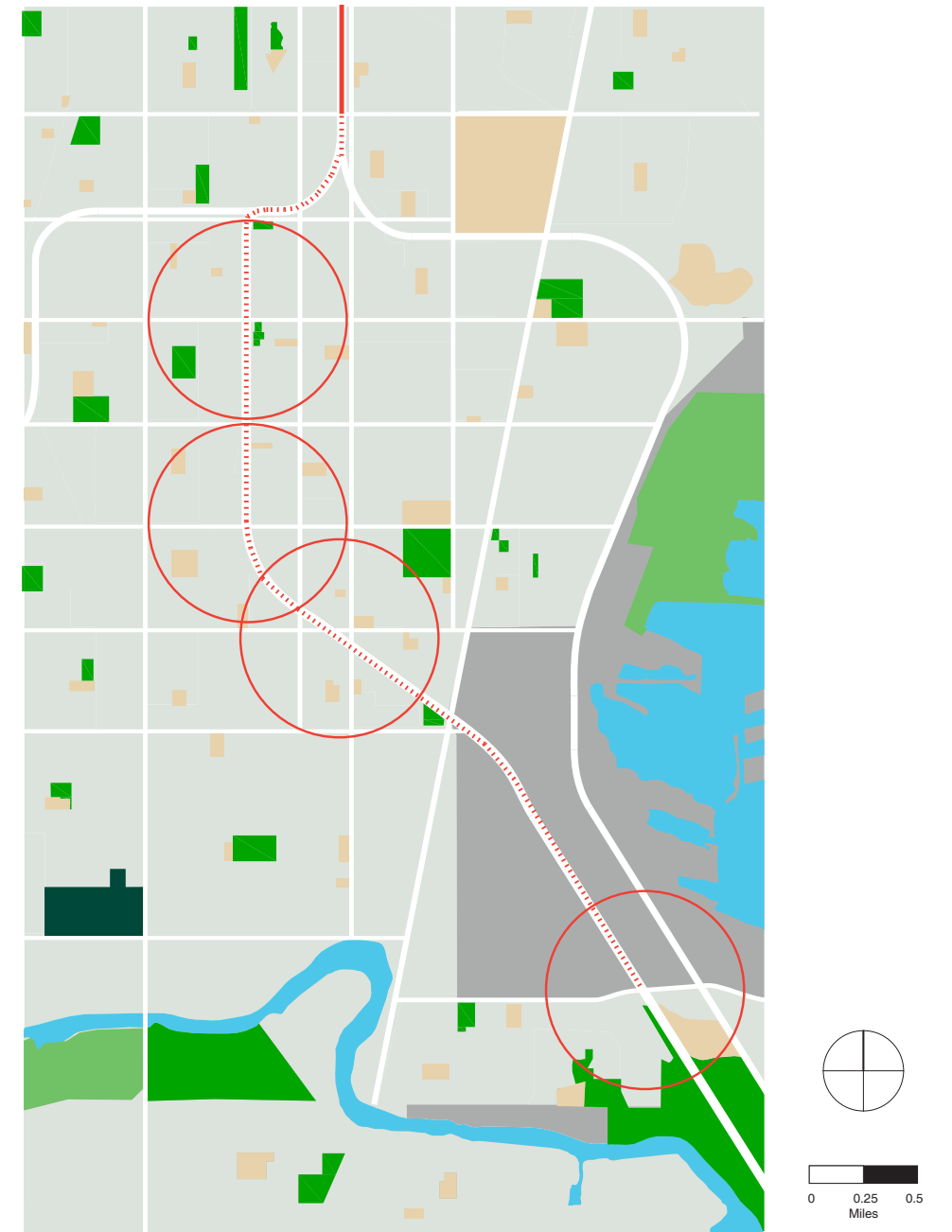
0 0.25 0.5
Miles



most affected areas



proposed extension stops



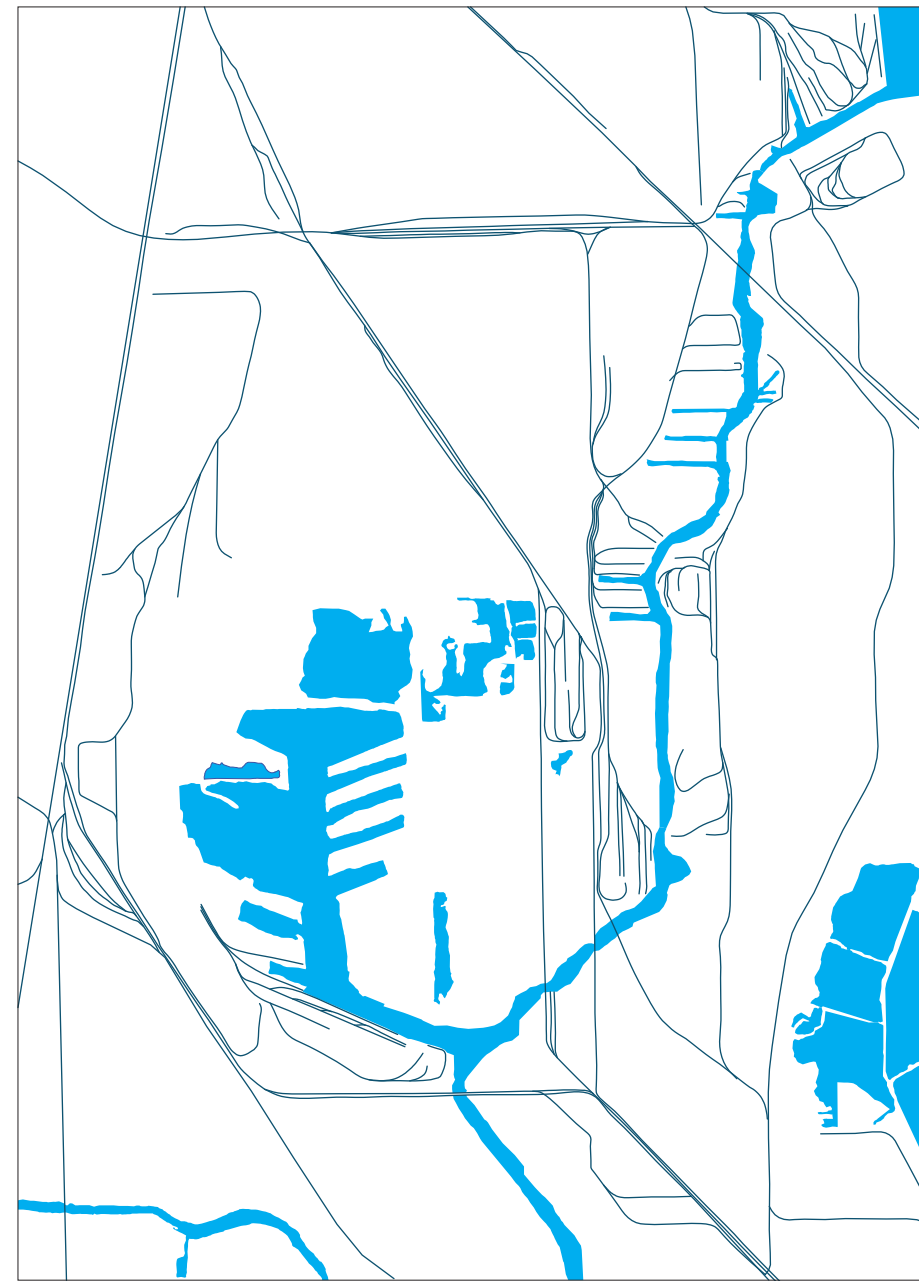
existing infrastructure +
intermodal nodes

heavy rail transit

27+ freight trains per day

9,000,000 containers per year

9 railroad companies laid track between 1850-1900



0' 1500' 3000' 6000'

50 acres

heavy truck transit

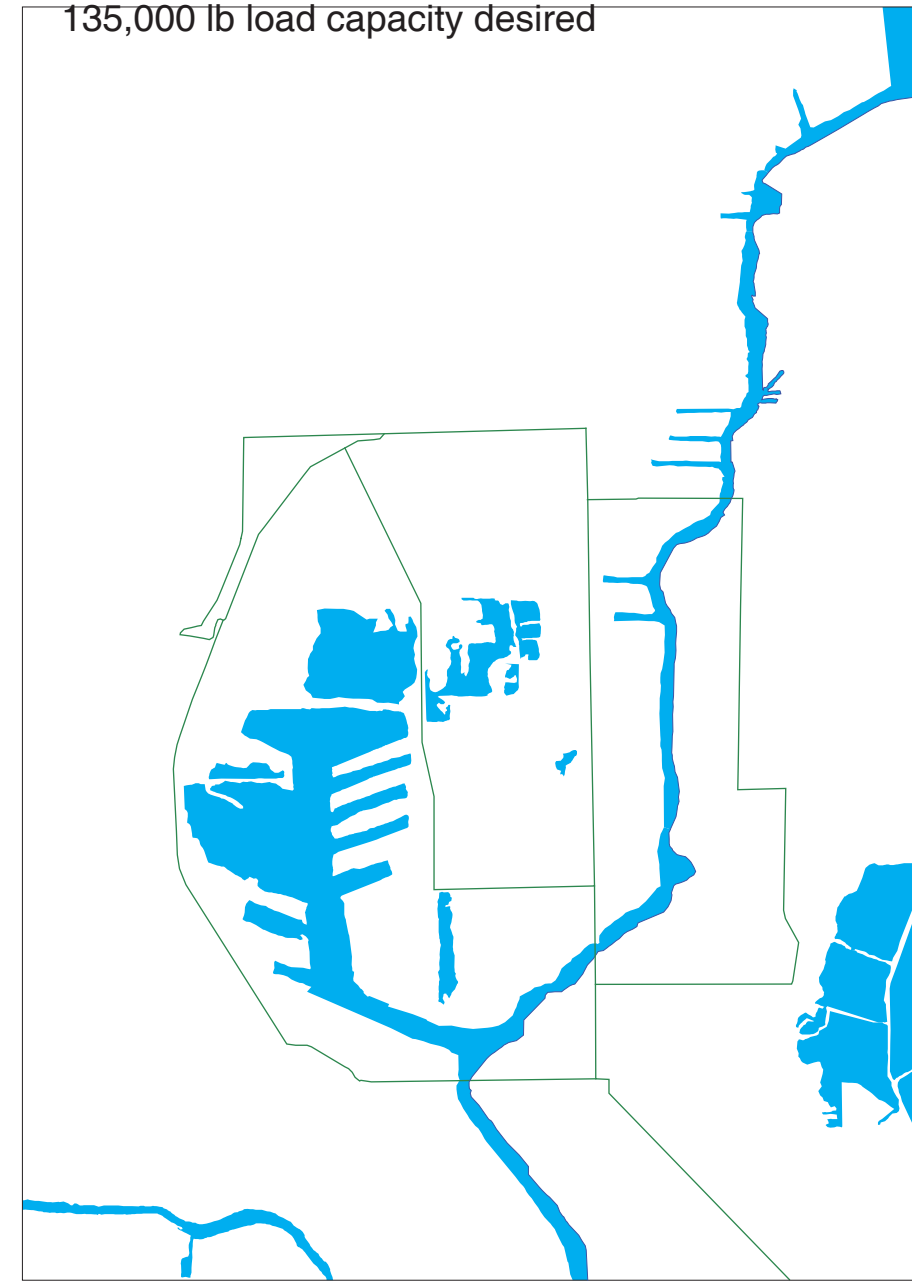
31 intermodal ports

7 heavy trucking routes

all 7 in disrepair and are under utilized

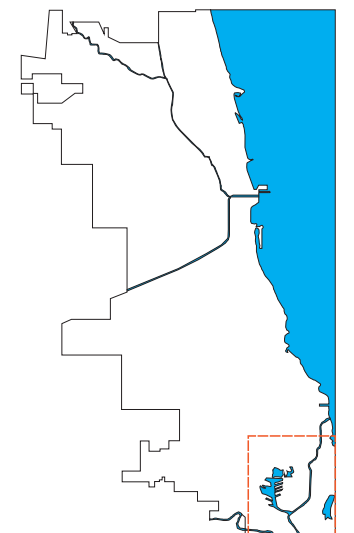
80,000 lb load capacity currently

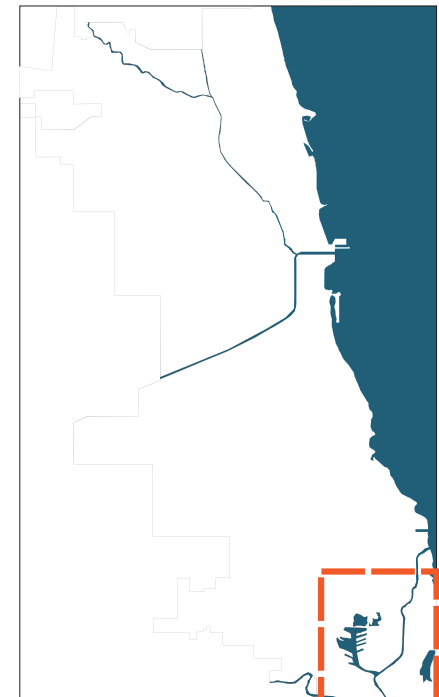
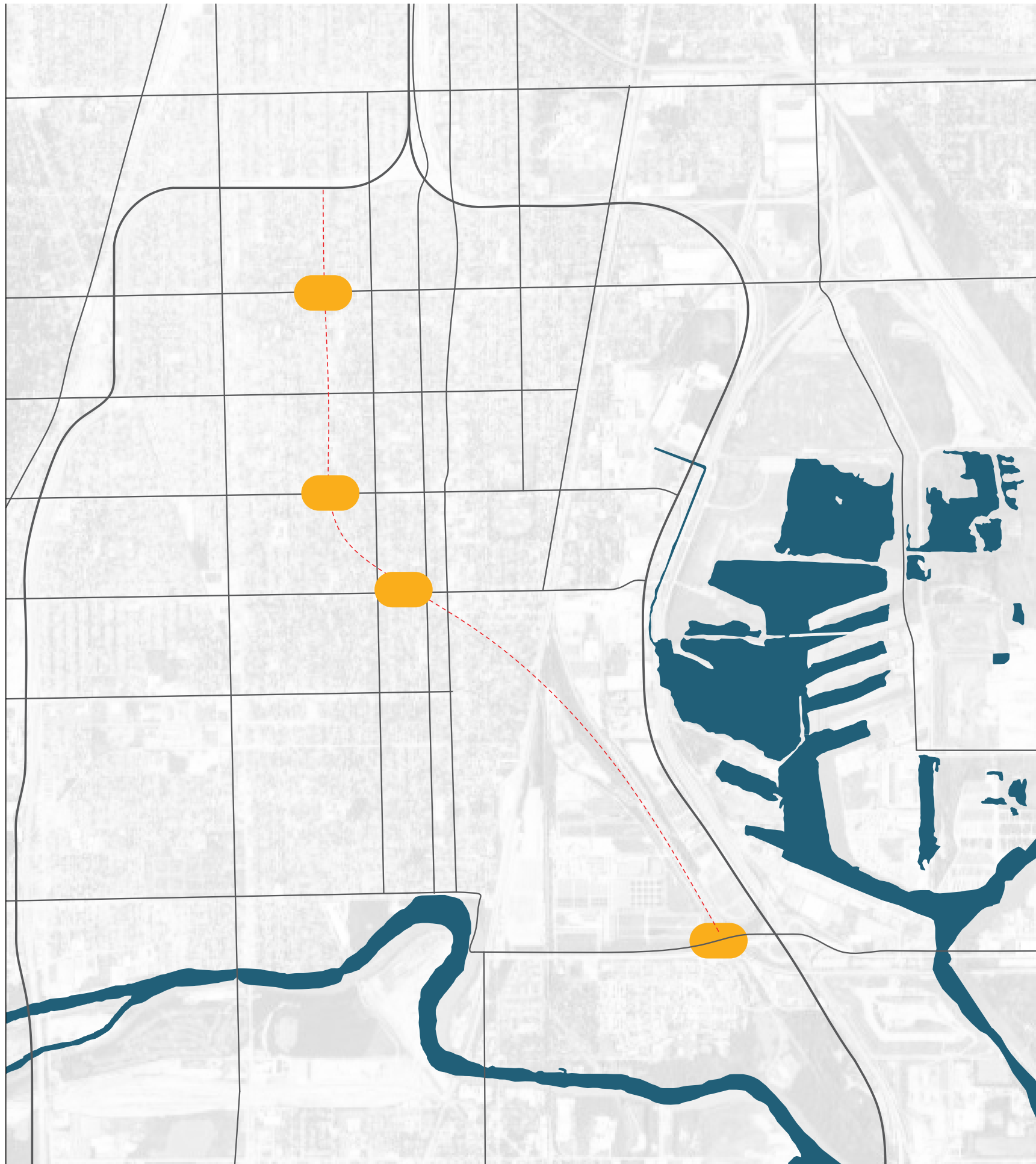
135,000 lb load capacity desired



0' 1500' 3000' 6000'

50 acres





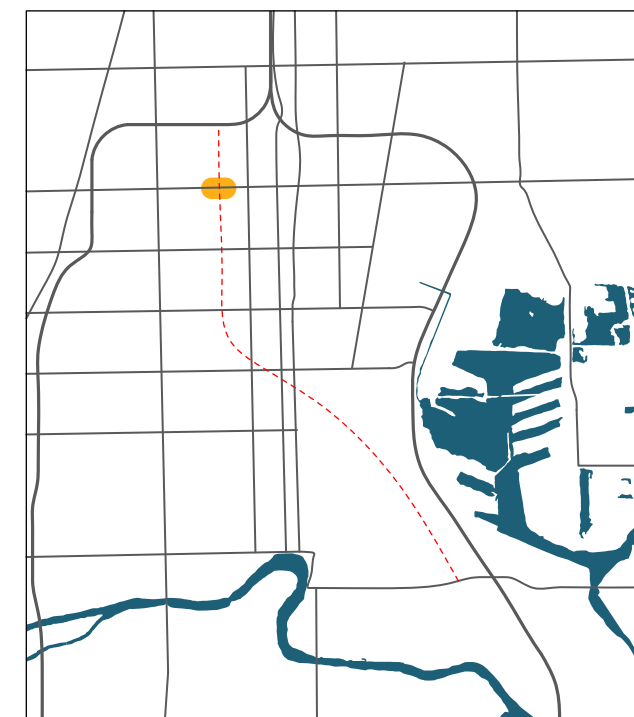
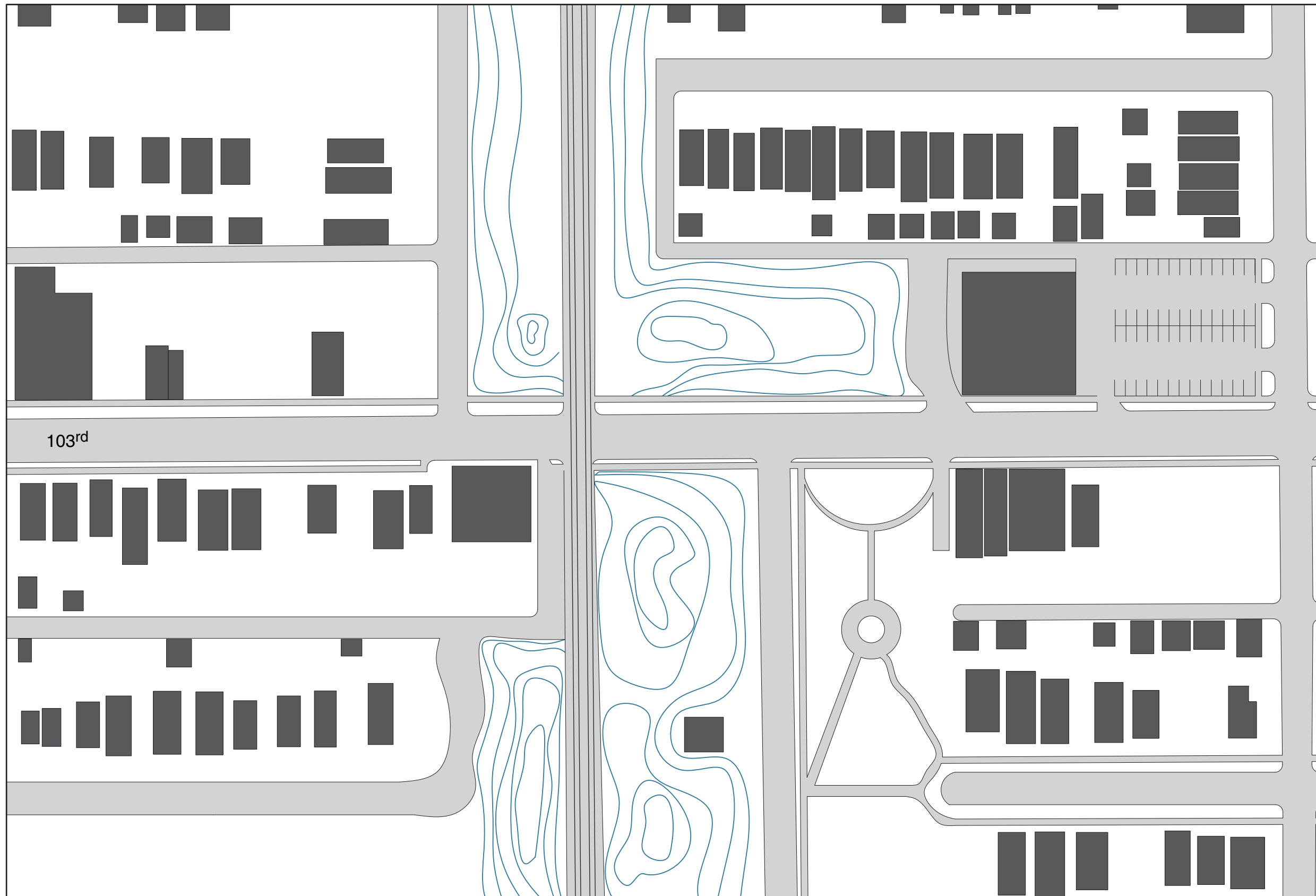
proposed stops

Based on the demographic information in the previous section, the new stops for the CTA Red Line extension should be located at 103rd, 111th, 115th and 130th streets respectively. These stops will benefit the members of the community by increasing their access to public transportation. In addition, by using the existing heavy rail transit tracks that are at grade this project will decrease its impact on the environment and demonstrate how existing infrastructure can be adopted for new uses; thus, reducing waste and energy.

In addition, by using the vacant land along these existing tracks to create constructed wetlands serves several purposes. First, by creating constructed wetlands will increase the amount of green space within the various communities and alter the urban landscape to a more natural landscape. Second, using vacant lots for constructed wetlands will provide migratory birds and other animal life with a larger natural habitat. Third, and most significantly, the constructed wetlands will serve as a filter for surface runoff and clean this runoff and return the water back the aquifer and eventually Lake Michigan. This will help mitigate the amount of water that Chicago takes from Lake Michigan and does not return the same amount to the lake.

103rd street

topographic plan

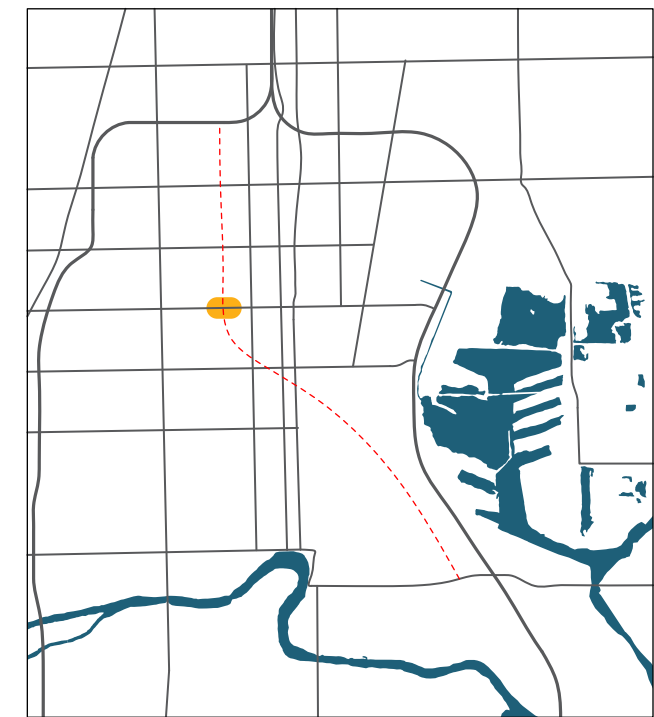
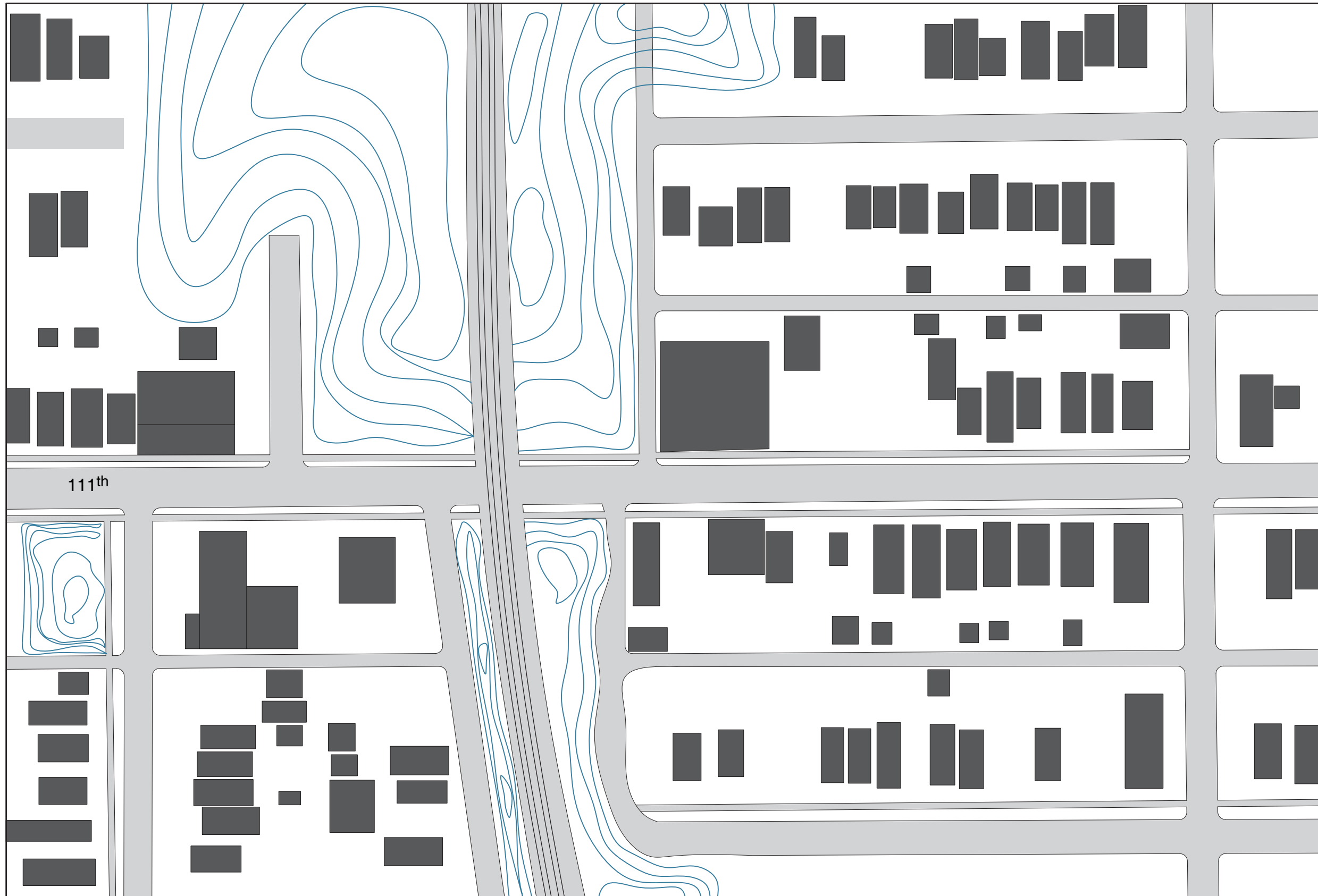


0' 100' 200' 300'



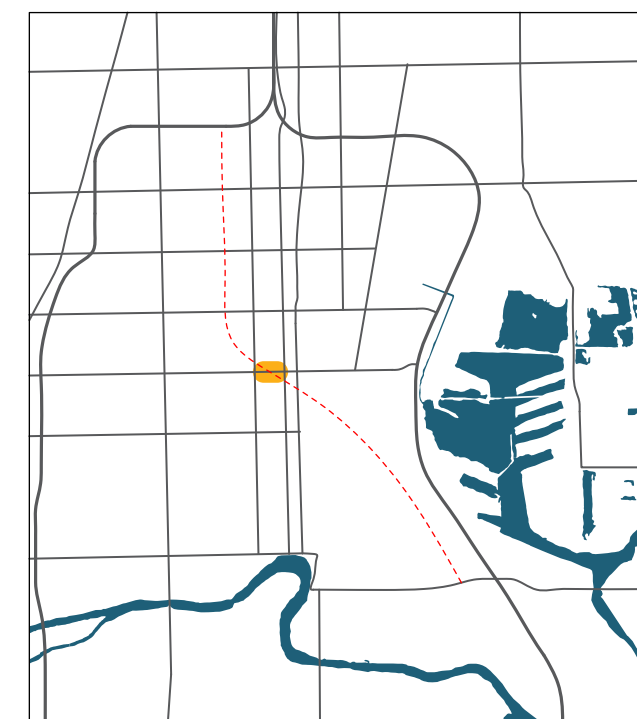
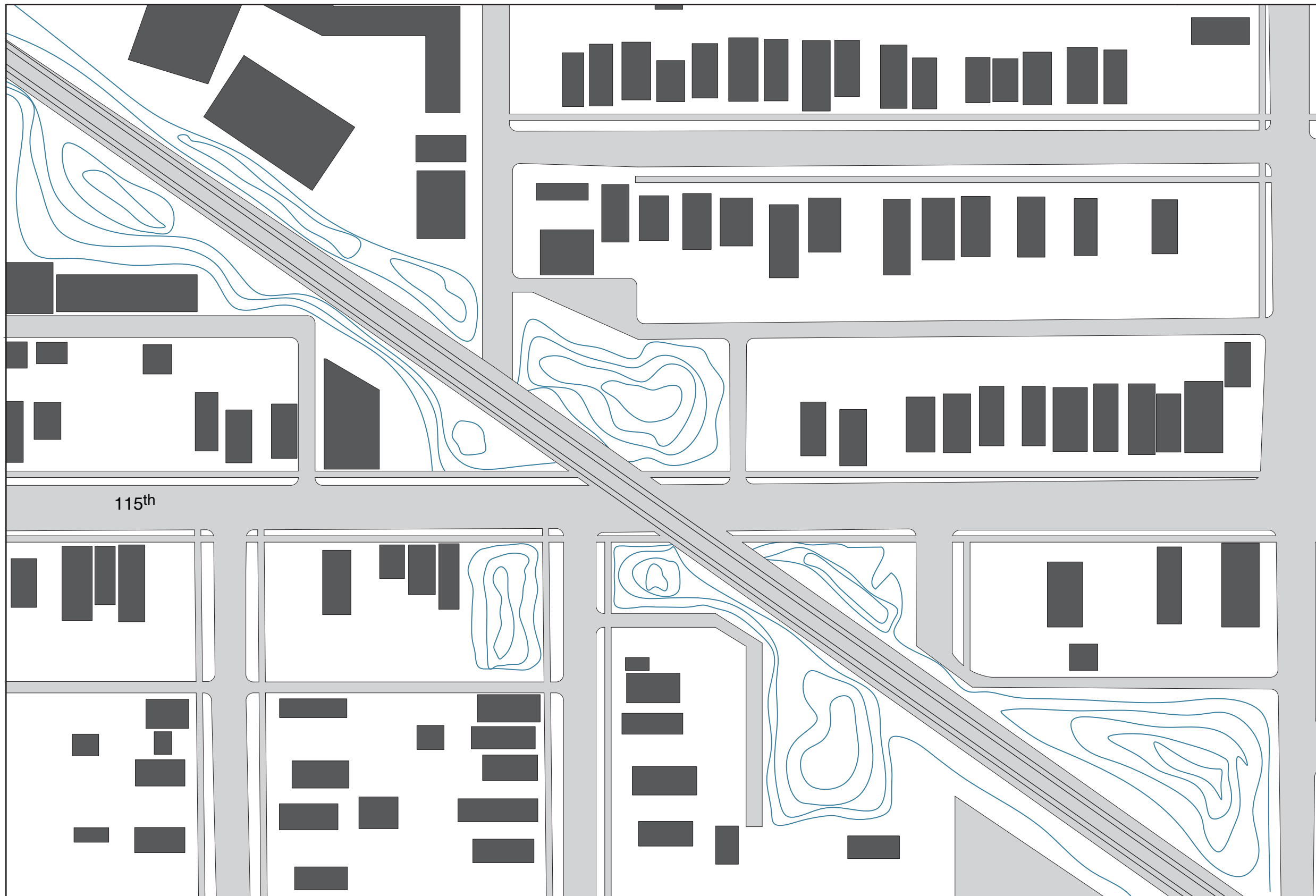
111th street

topographic plan



115th street

topographic plan

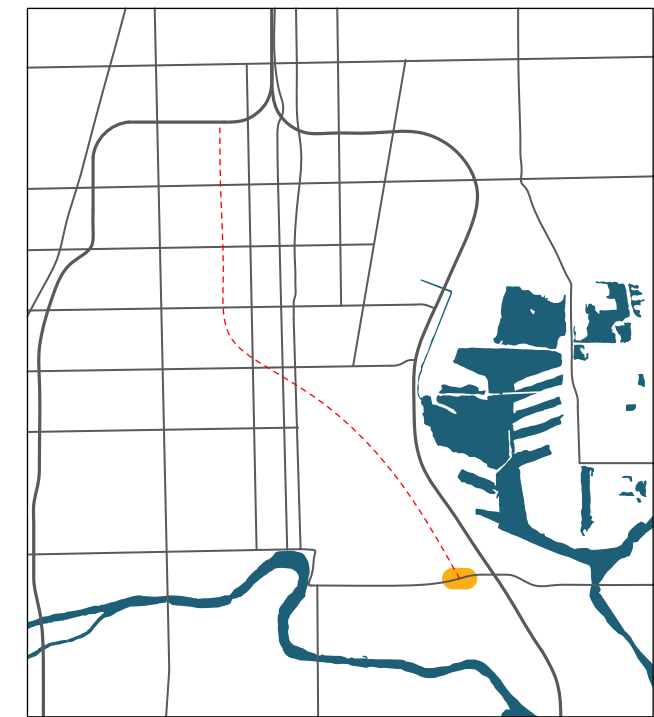
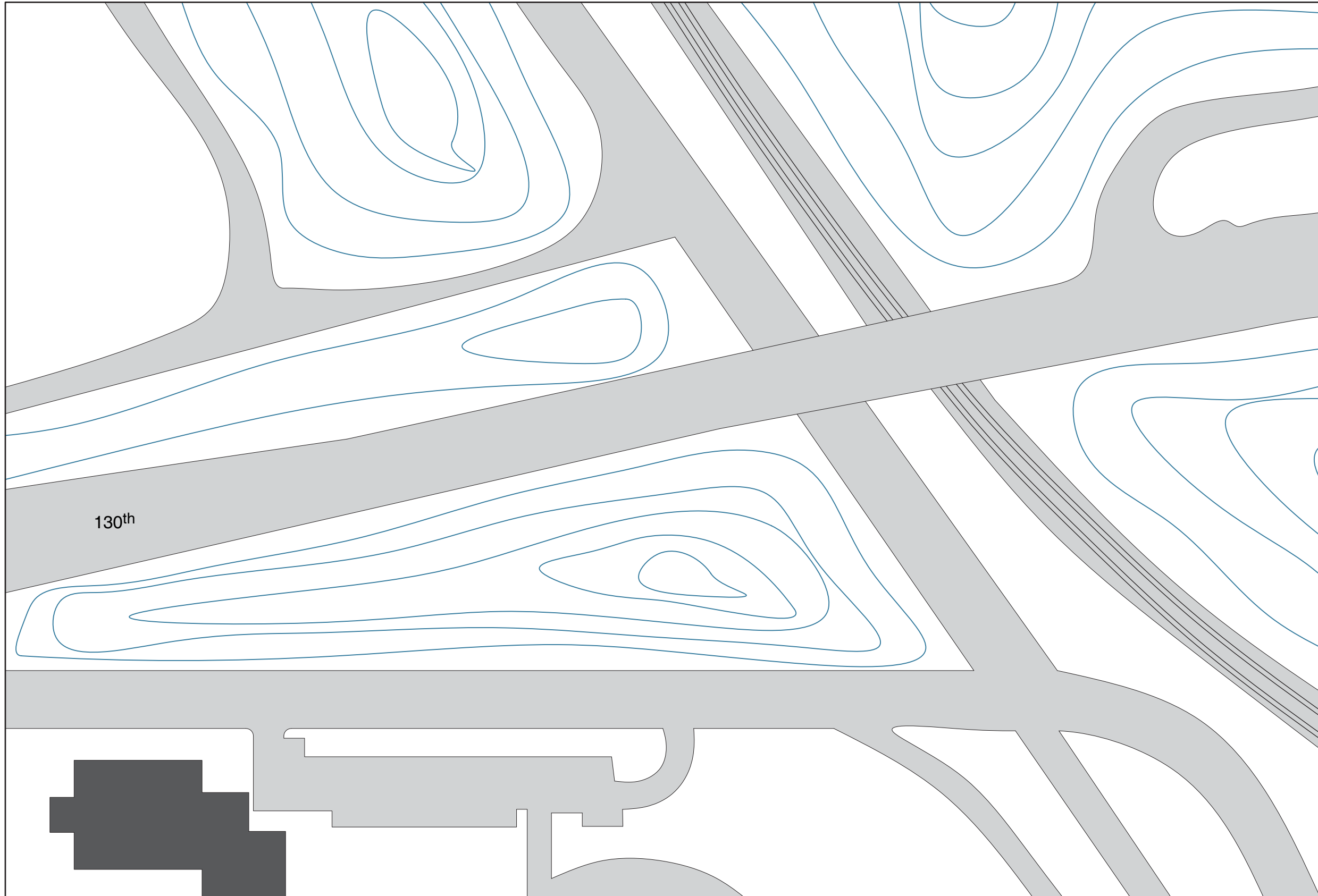


0' 100' 200' 300'



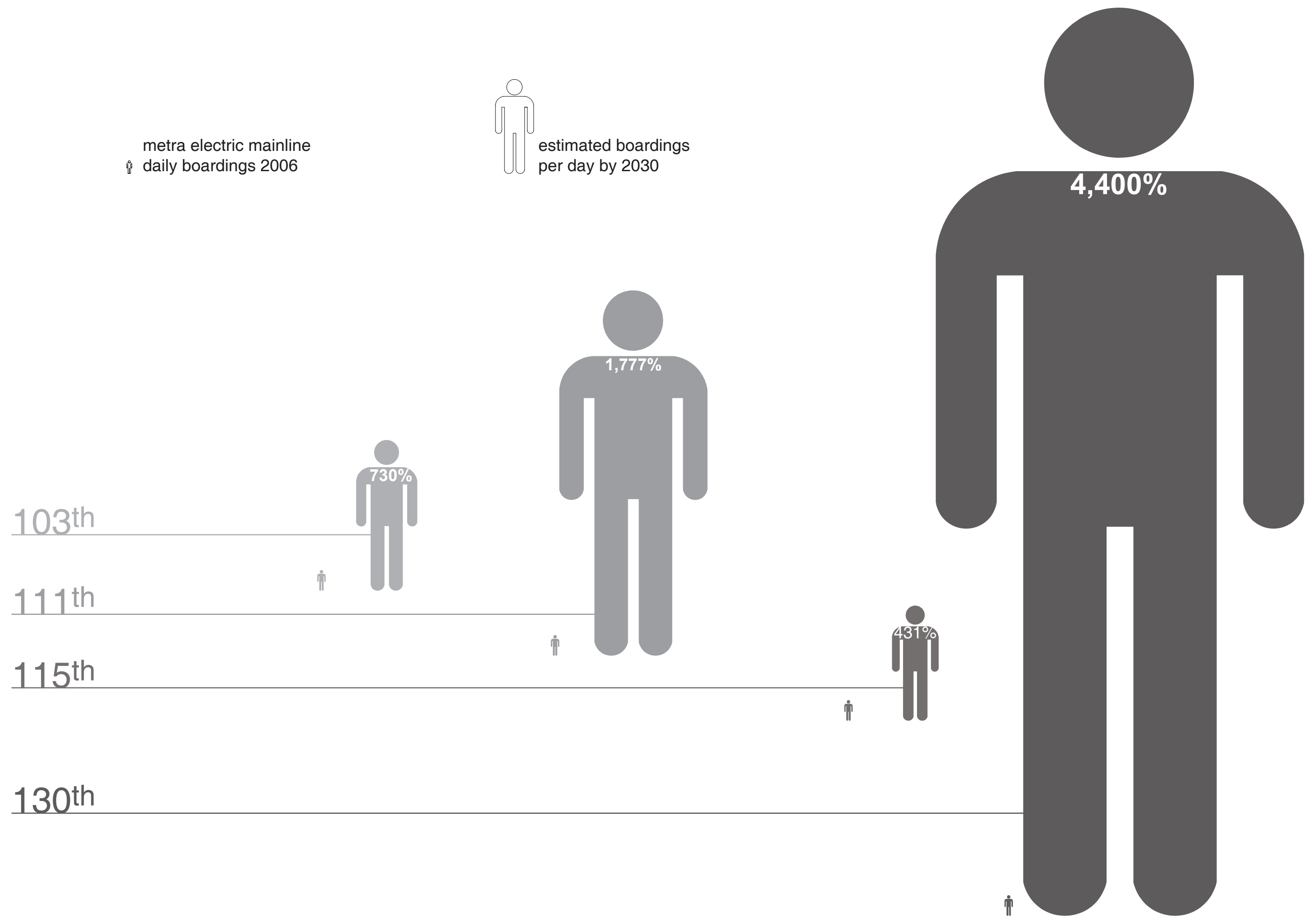
130th street

topographic plan



metra electric mainline
daily boardings 2006

estimated boardings
per day by 2030

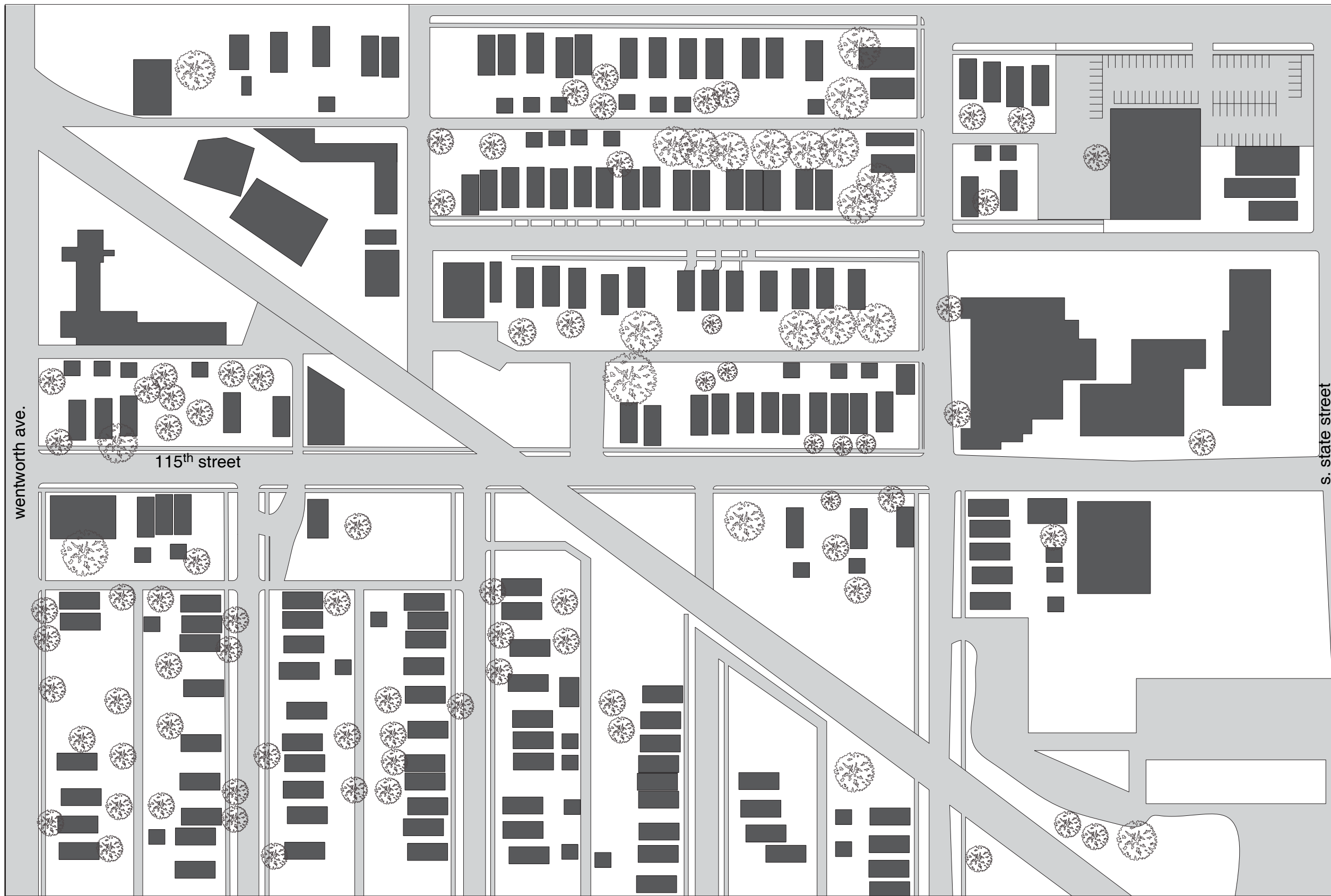


site analysis

By choosing the 115th street site for this project I was able to address several design issues with the site that enhanced the overall design of the project. First, the amount of vacant land enabled this stop to be an interblock, intermodal node. Second, the combination of residential and commercial development, as well as educational, provided a strong case for this site to become an intermodal node. Third, the circulation patterns enabled the stop to be located adjacent to the main vehicular traffic without congesting the existing traffic patterns. Lastly, the interblock stop enables people to experience the wetlands on their way to and from work and enjoy these green spaces throughout the year.

115th street

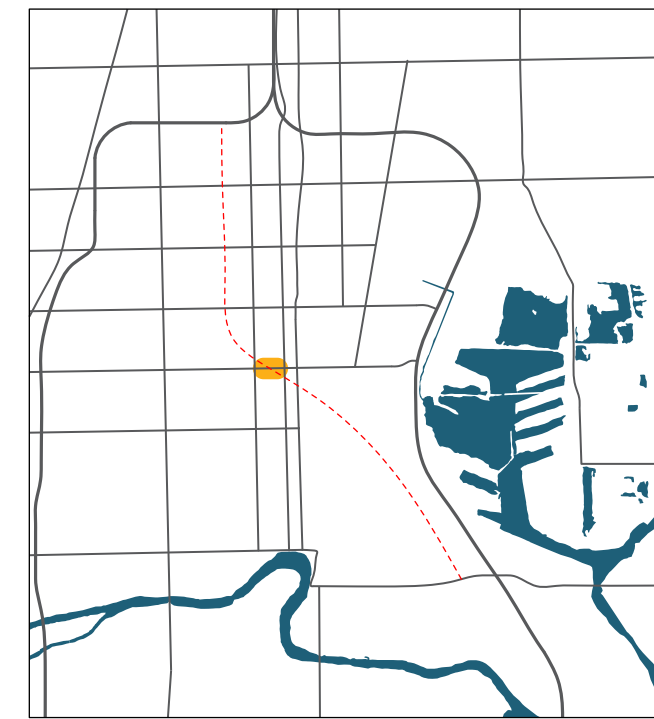
figure ground



wentworth ave.

115th street

s. state street

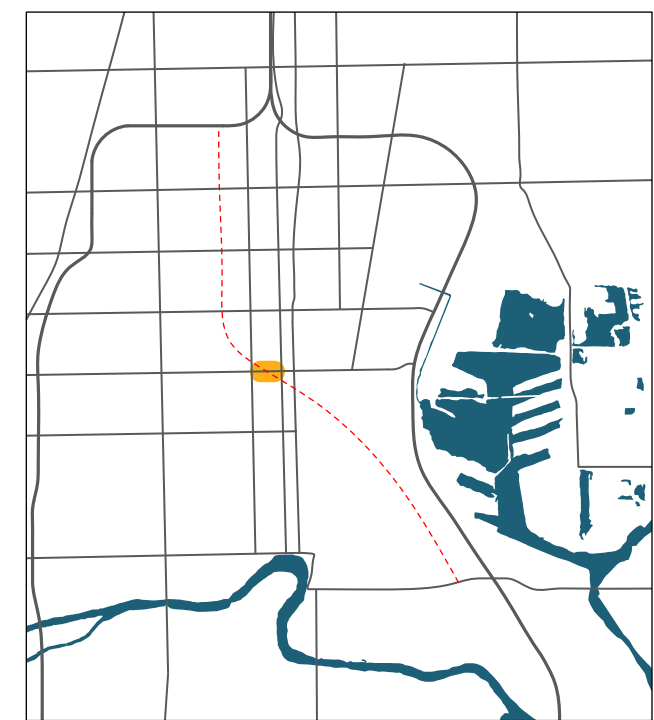
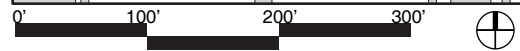
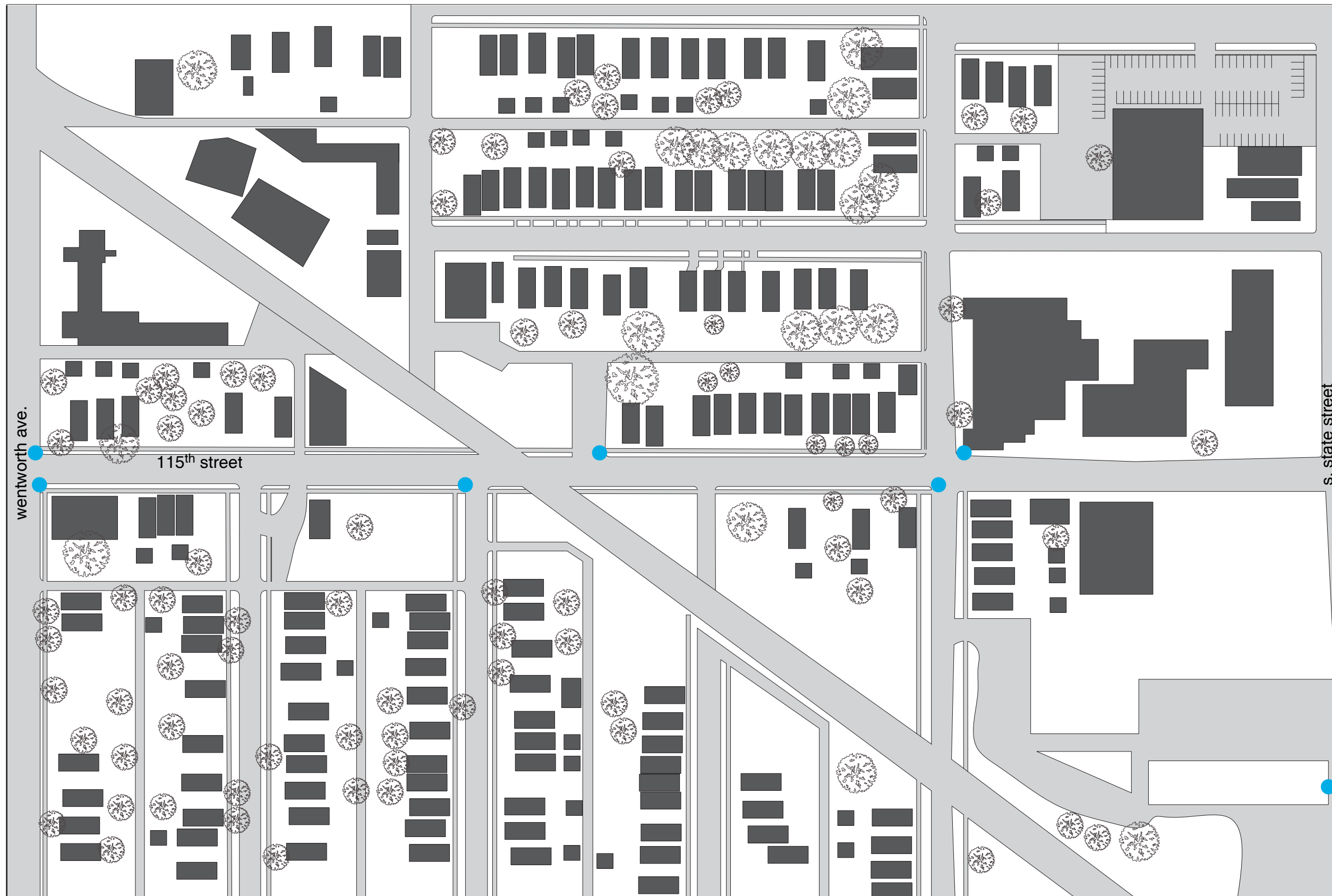


115th street

public transportation



115th & wentworth
115th & perry
115th & state
michigan & kensinton



115th street

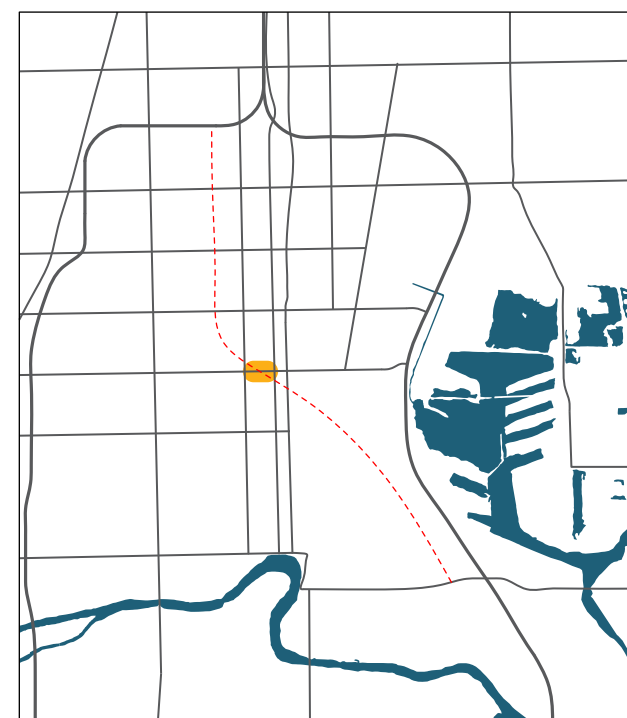
zoning



manufacturing

commercial

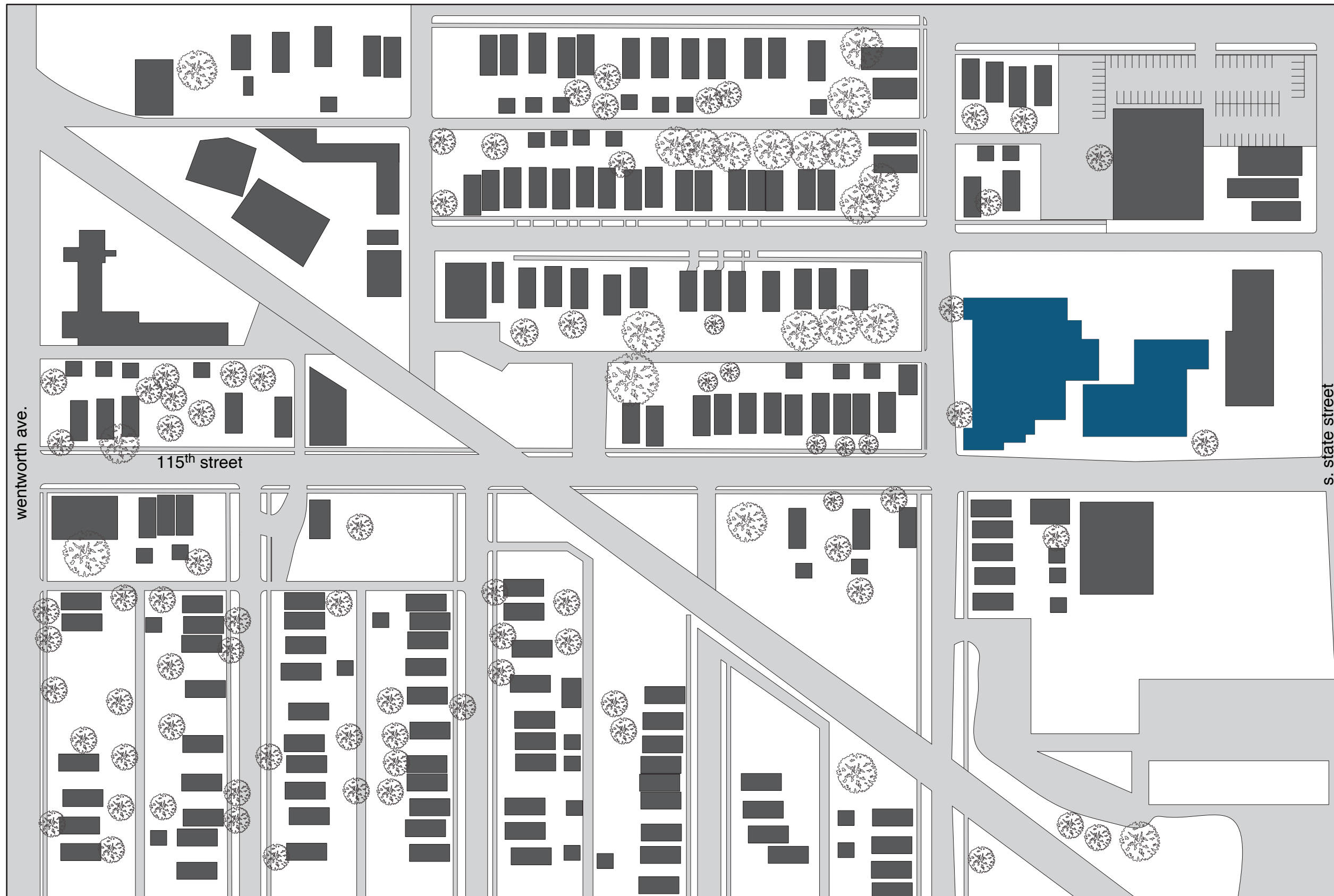
schools



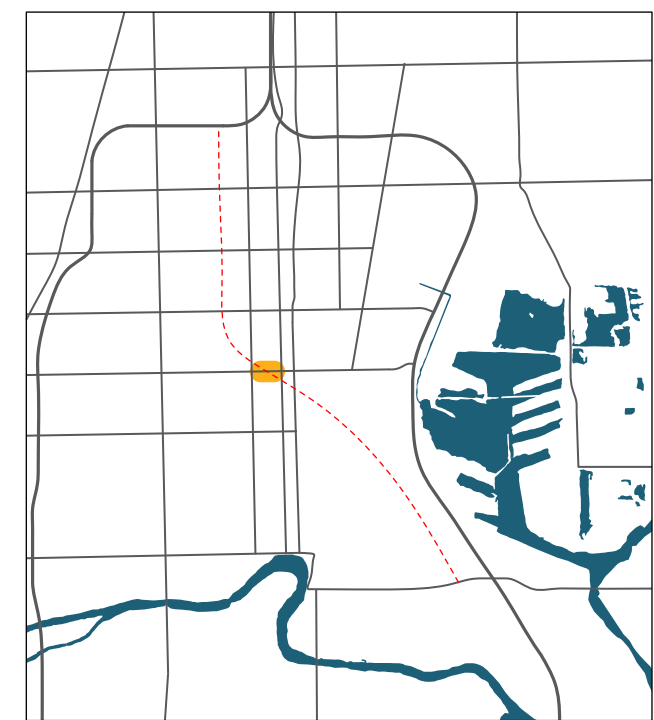
0' 100' 200' 300'



115th street schools



curtis elementary school



0' 100' 200' 300'



design considerations

wetlands experience

adjacent experience

- provide some level of interaction with wetlands
- buffer between users and natural environment
- some level of impact on the wetlands



direct experience

- enable people to experience the natural environment and the remediation process
- supports birding
- stimulates various senses



elevated experience

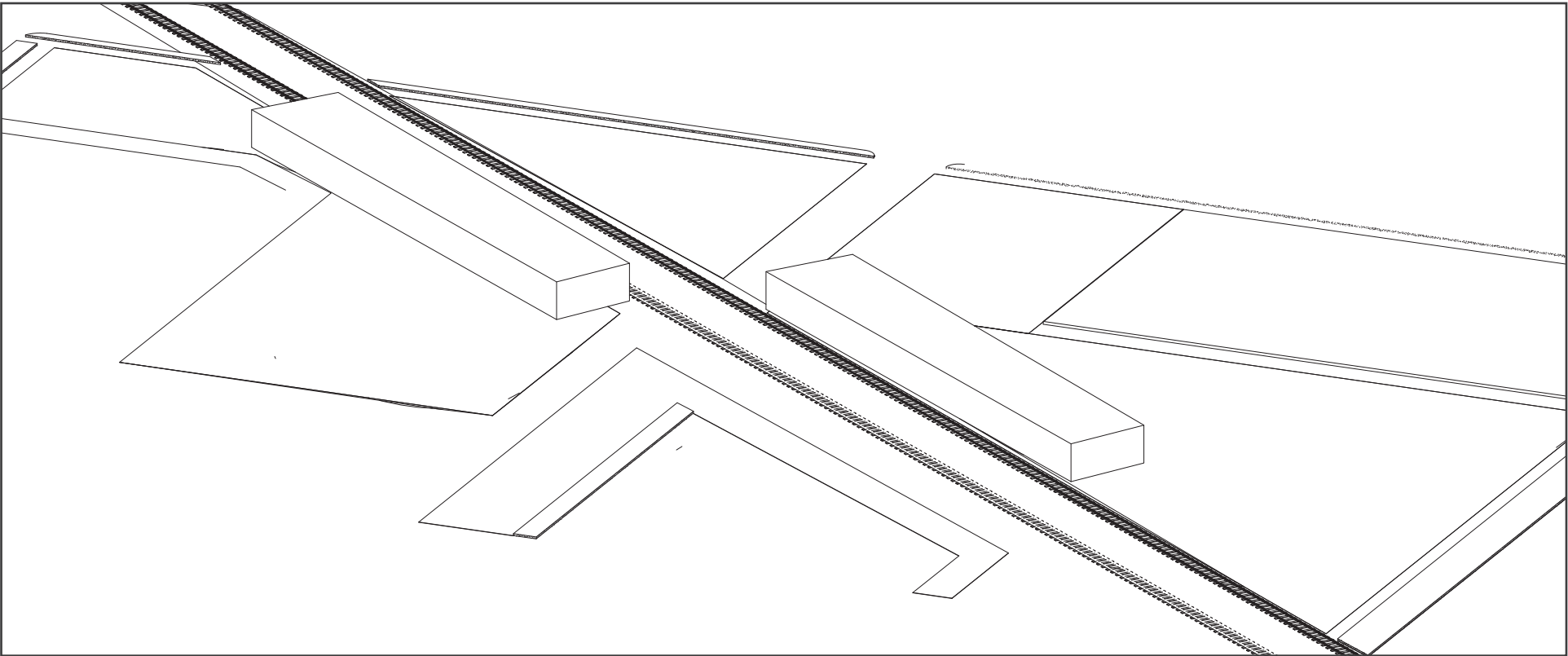
- minimal impact on the wetlands
- minimal impact on natural wildlife



building concept

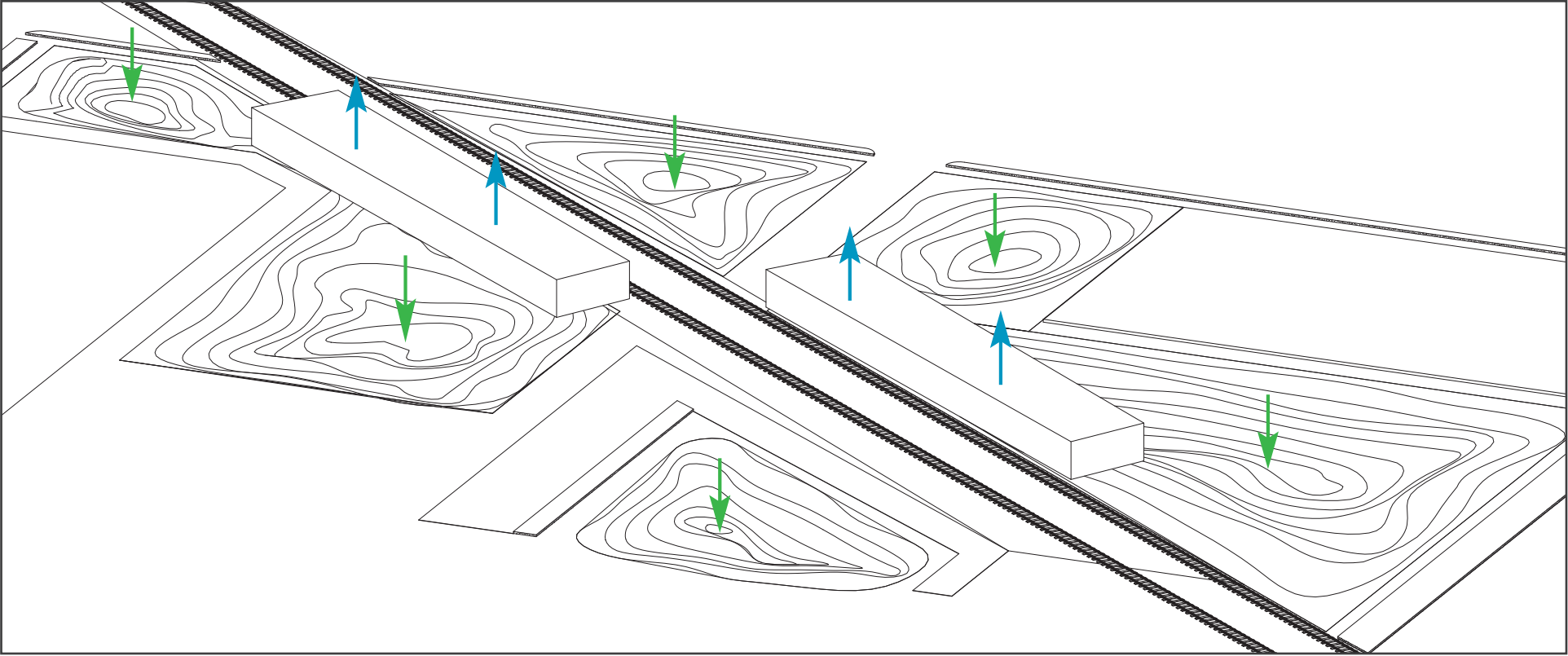
The concepts that led to the development of this building were permeability, integration and circulation. Permeability played an important role in the development of this project in order to decrease surface runoff and increase the amount of green space within the community. The purpose of integration was to combine man-made infrastructure with the natural ecology of the site in order to demonstrate how a symbiotic relationship can exist between the two entities. Lastly, the circulation of human beings and the ecology of the site needed to be fluid while at the same time separated from one another. These concepts led to the development of hybrid CTA stop that combines the man-made infrastructure with nature ecology that used to exist in this area when it was first explored.

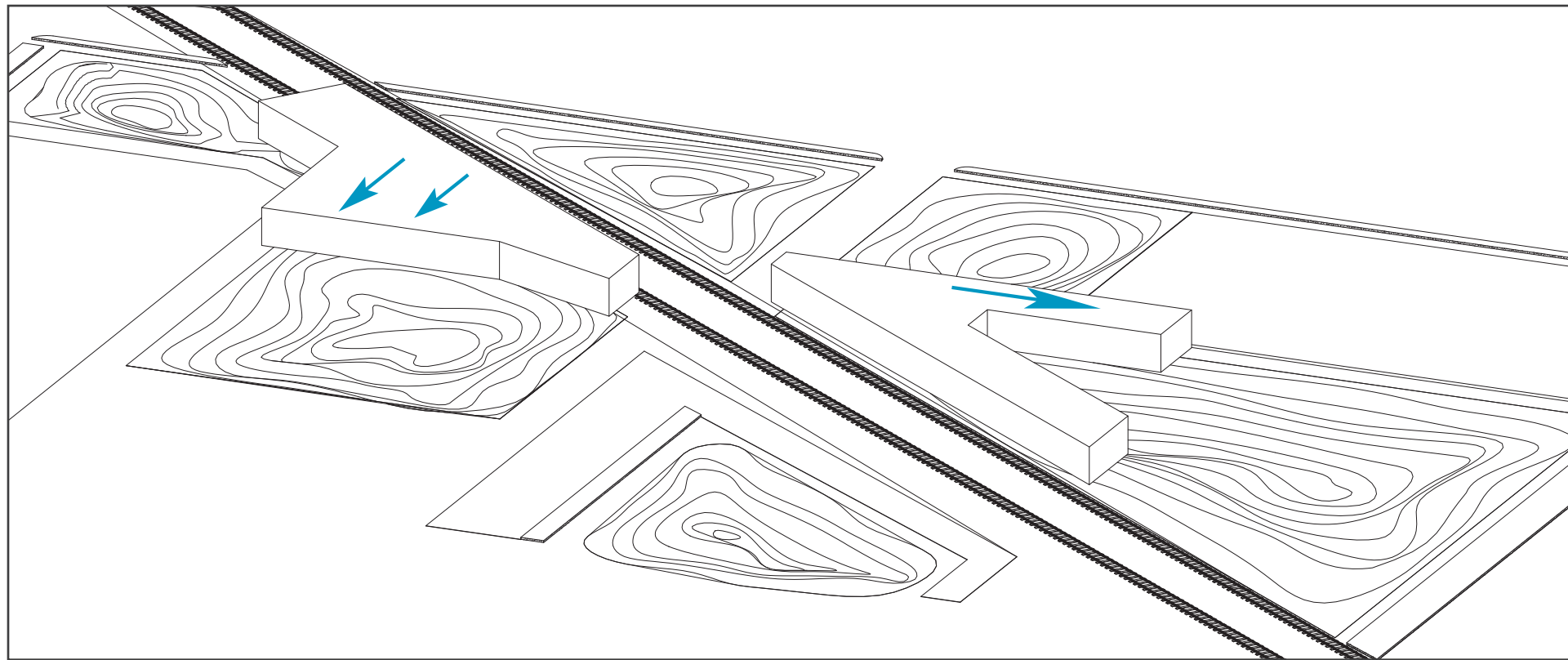
By using the existing heavy rail transit tracks at grade, this CTA stop will require two buildings on either side of the tracks. In addition, the vacant land surrounding this intermodal stop will enable a more fluid circulation system to be developed.



The vacant land surrounding this intermodal stop will be transformed into constructed wetlands to increase the amount of greenspace, address surface runoff and help filter toxins out of the water before it is returned to the lake. In addition, this will enhance the users' experience and develop a closer relationship with the natural environment in an urban area.

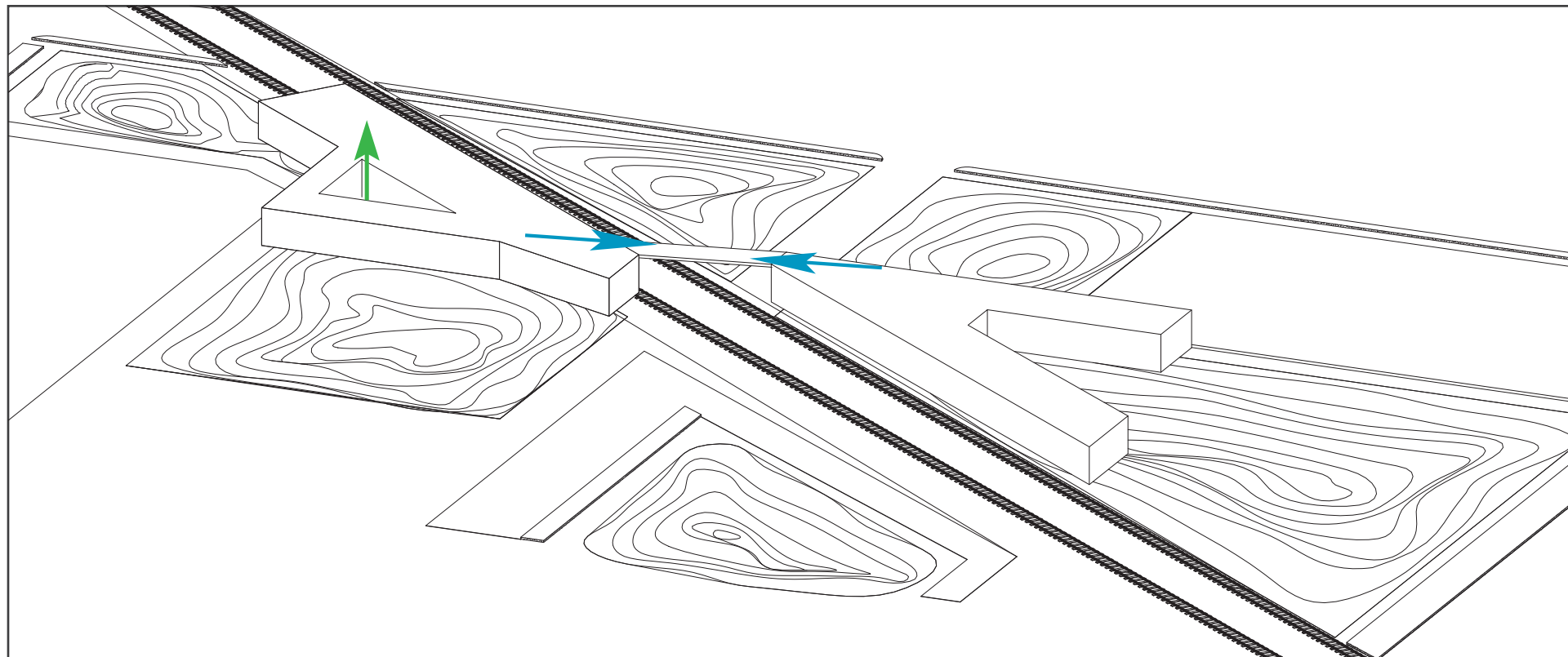
Elevating the buildings above grade by 4 feet accounts for the height discrepancy between the ground and the train entrance. Elevating the buildings also enables the ecology of the site to move freely beneath the building and does not impact the natural ecology as much as if the building were at grade.





Extending the west building further south helps to define the boundary between the existing alley and creates different perspectives of the constructed wetlands. In addition, this move enables people experience the wetlands at different elevations and spatial relationships to the constructed wetlands.

The east building is extruded to the east to identify the boundary of the site from the adjacent alley. In addition, this gesture directs the users' view out to the wetlands below and those constructed on the vacant land across the street.



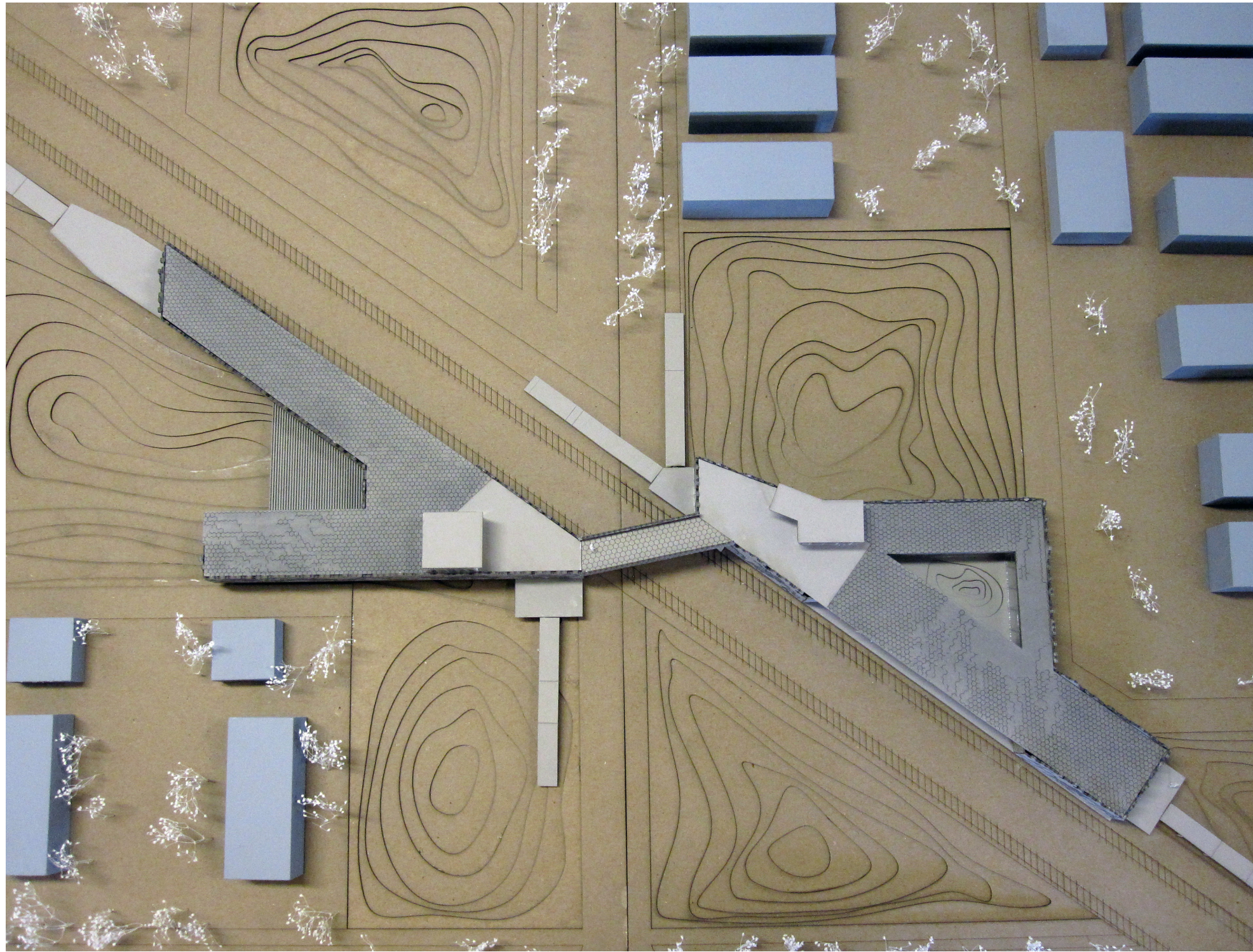
Creating an atrium space increases daylighting, provides a different vantage and experience of the wetlands and helps mitigate any disruption in the circulation of the ecology of the site.



Interior rendering of northwest entrance in west building.

plans

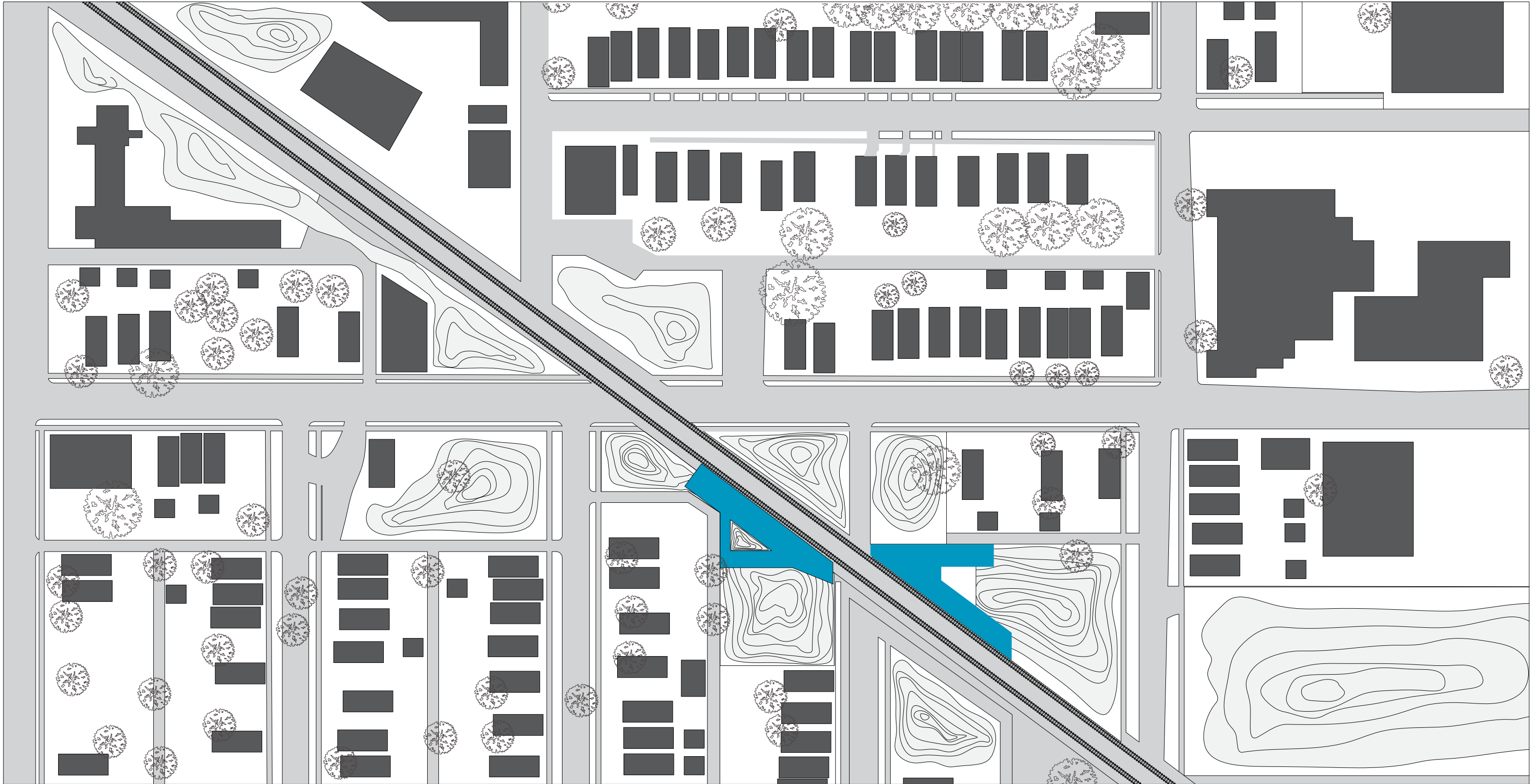
The plans for this intermodal node demonstrate how the various circulation patterns are separated from one another as well as the function of the various spaces. In addition, the plans reflect how the building form is derived to maximize the views and experience with the constructed wetlands and enhance the users' experience at this intermodal node.



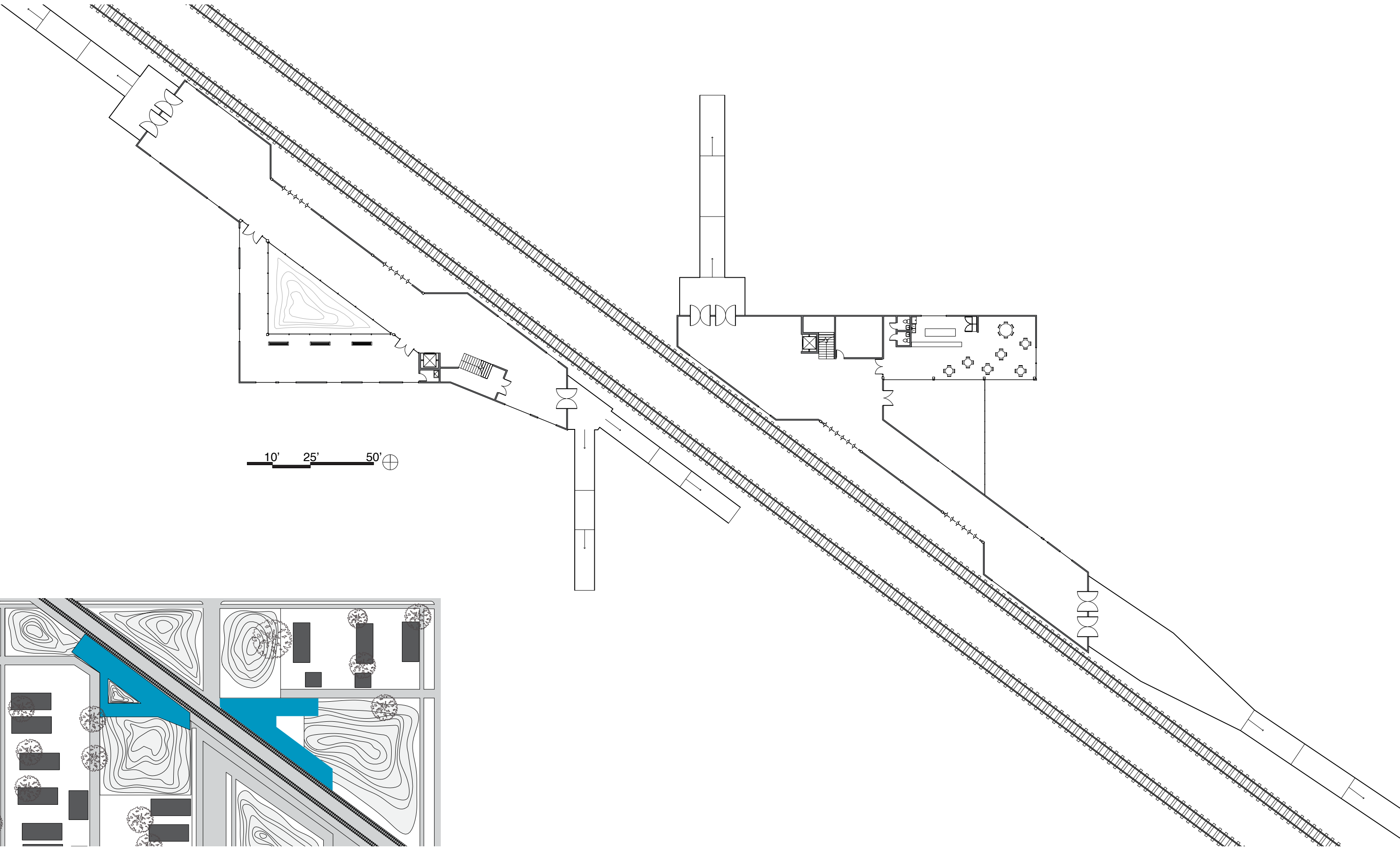
Arial photo of model.

site plan

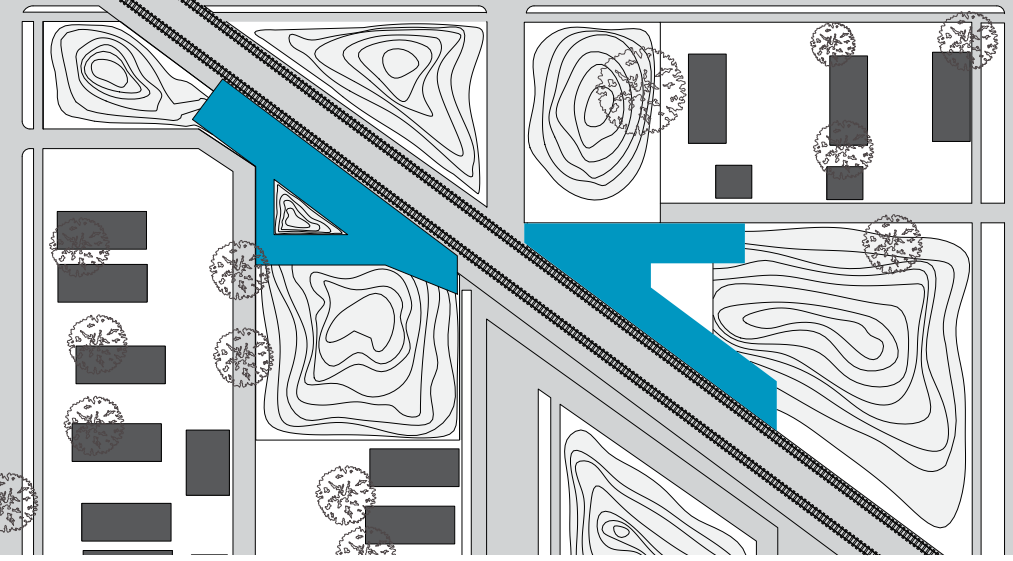
115th street + s. lafayette ave.



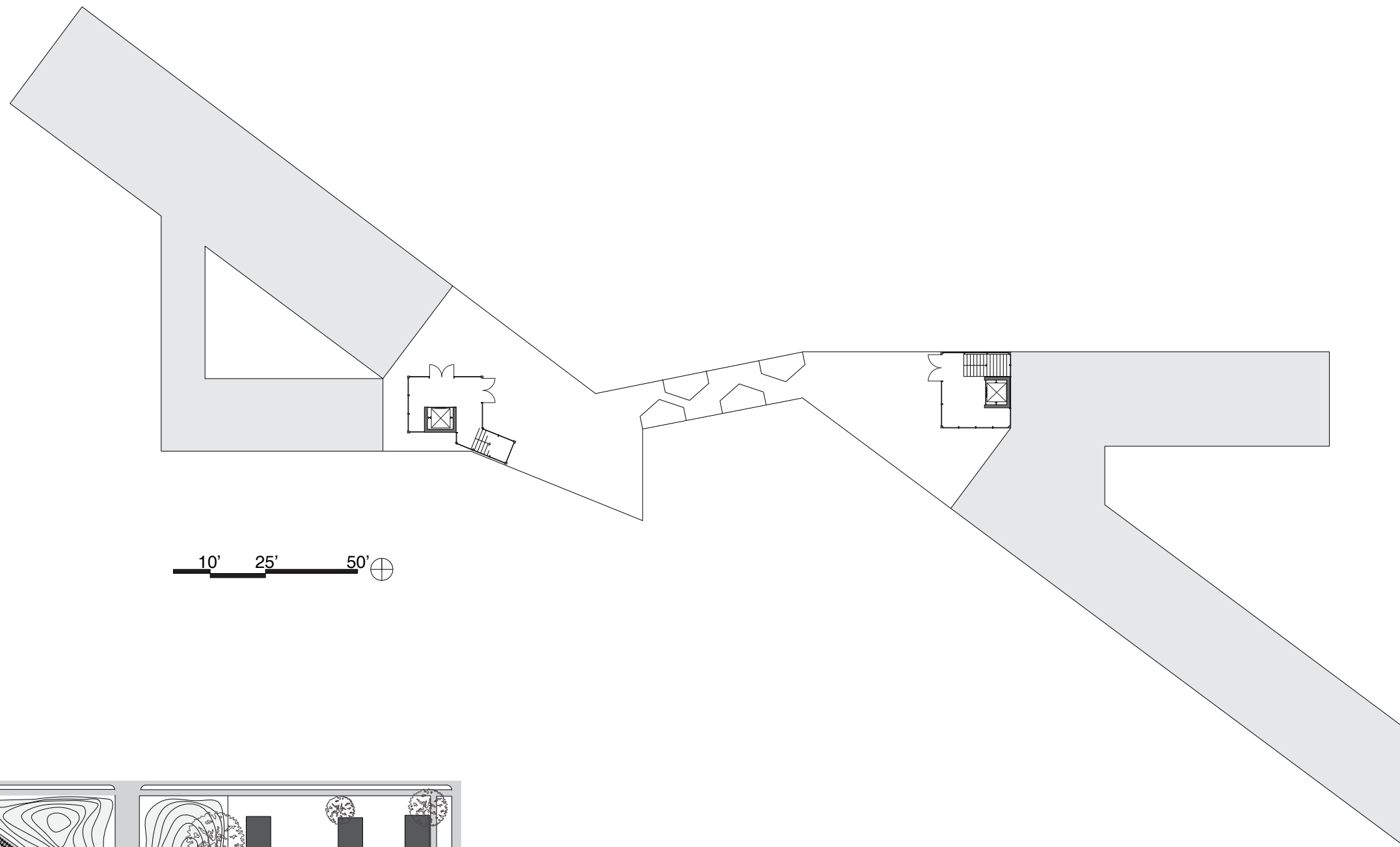
floor plan



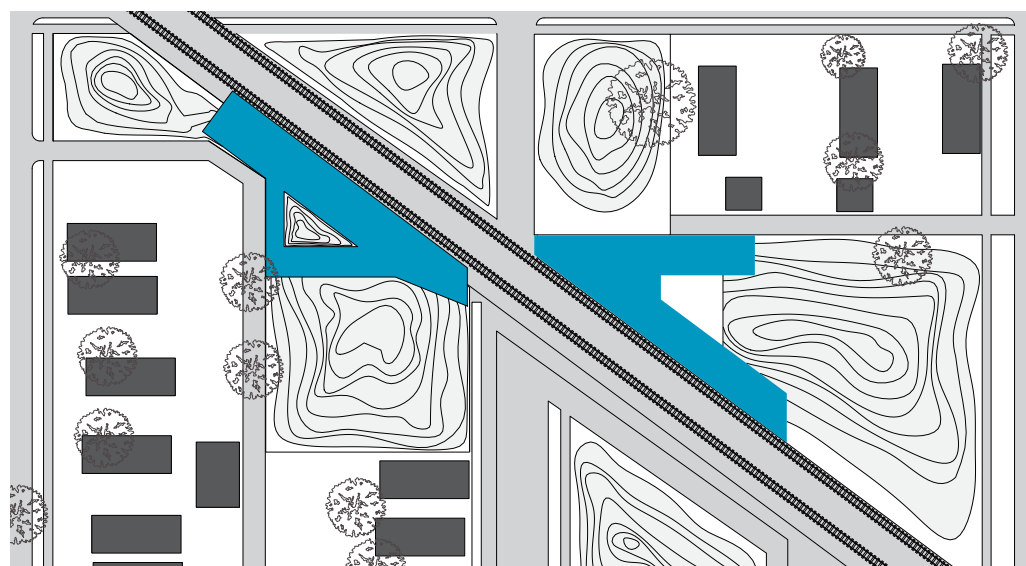
10' 25' 50' ⊕



roof plan

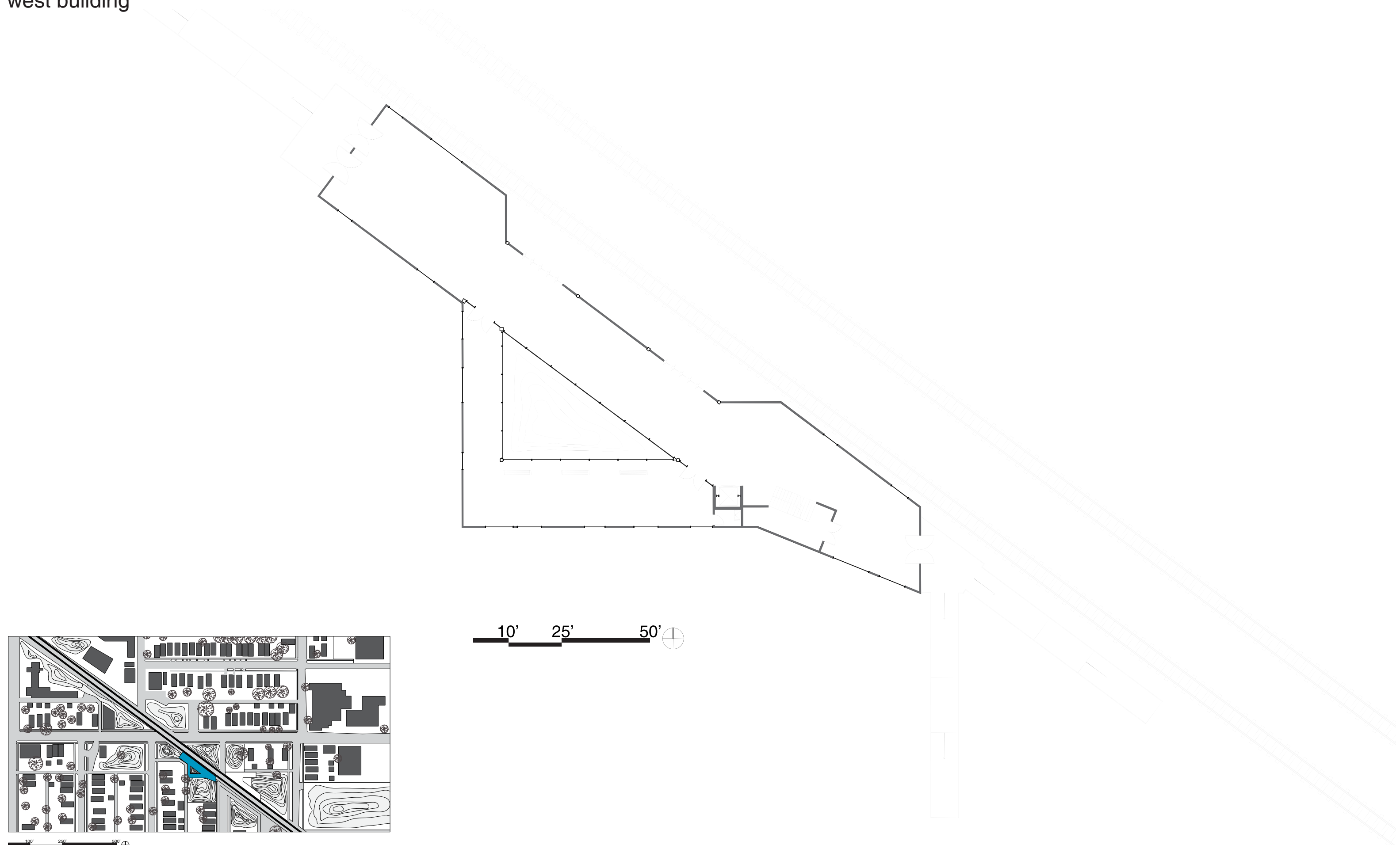


10' 25' 50' ⊕



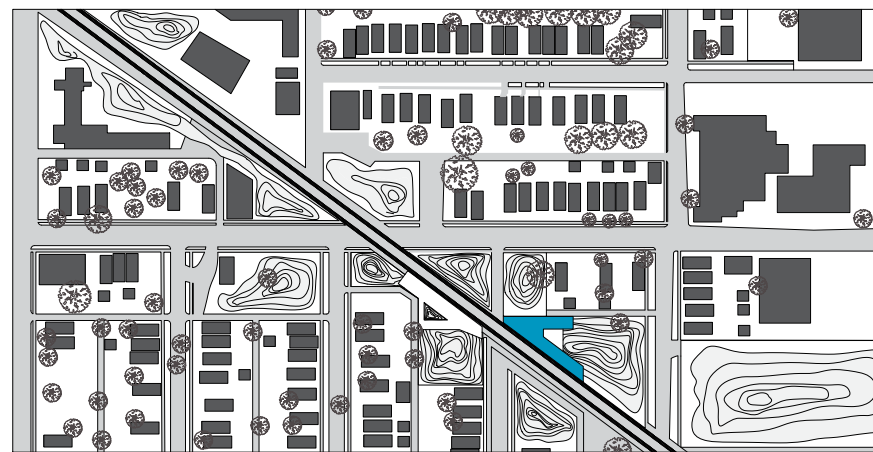
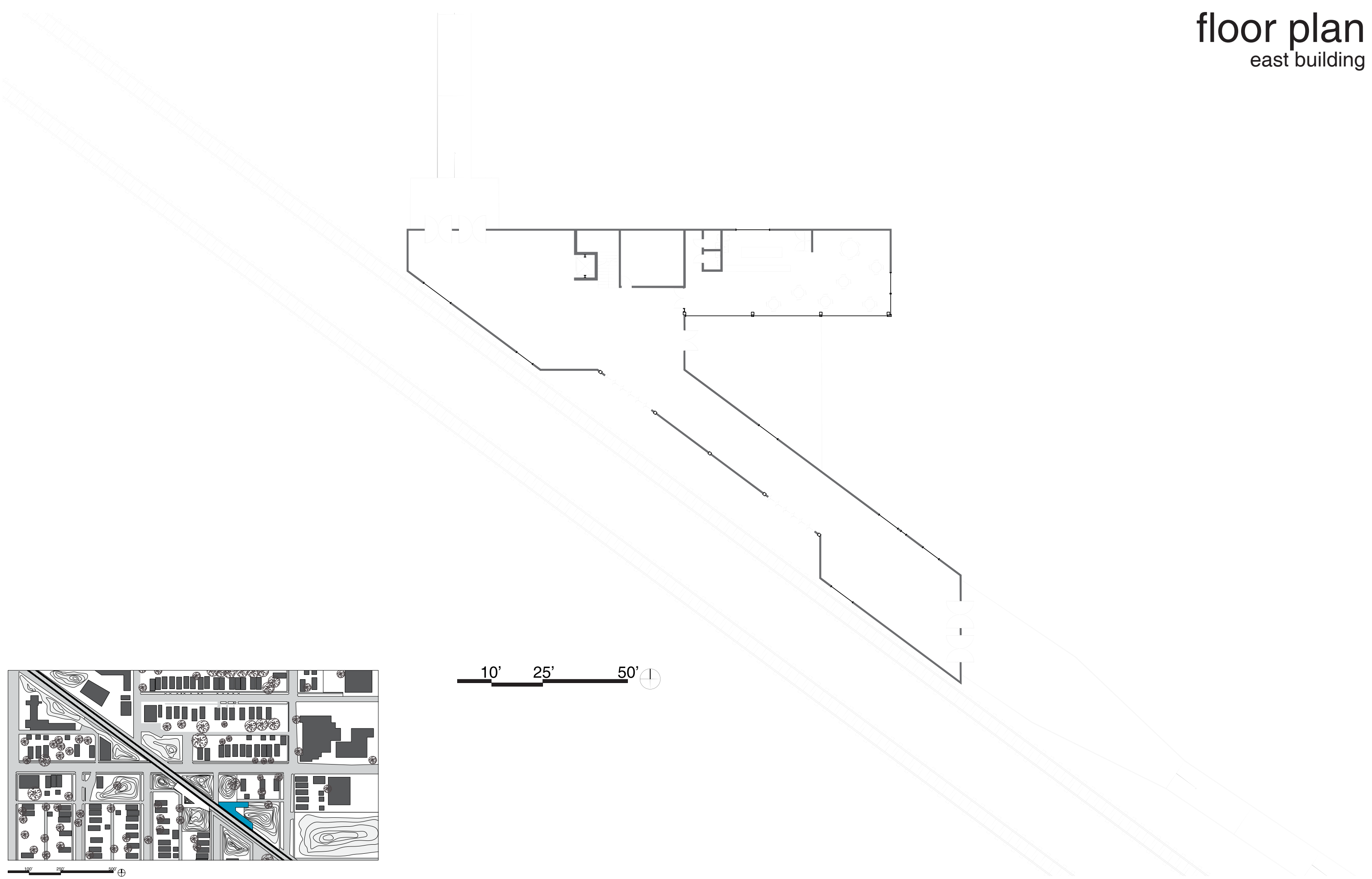
floor plan

west building



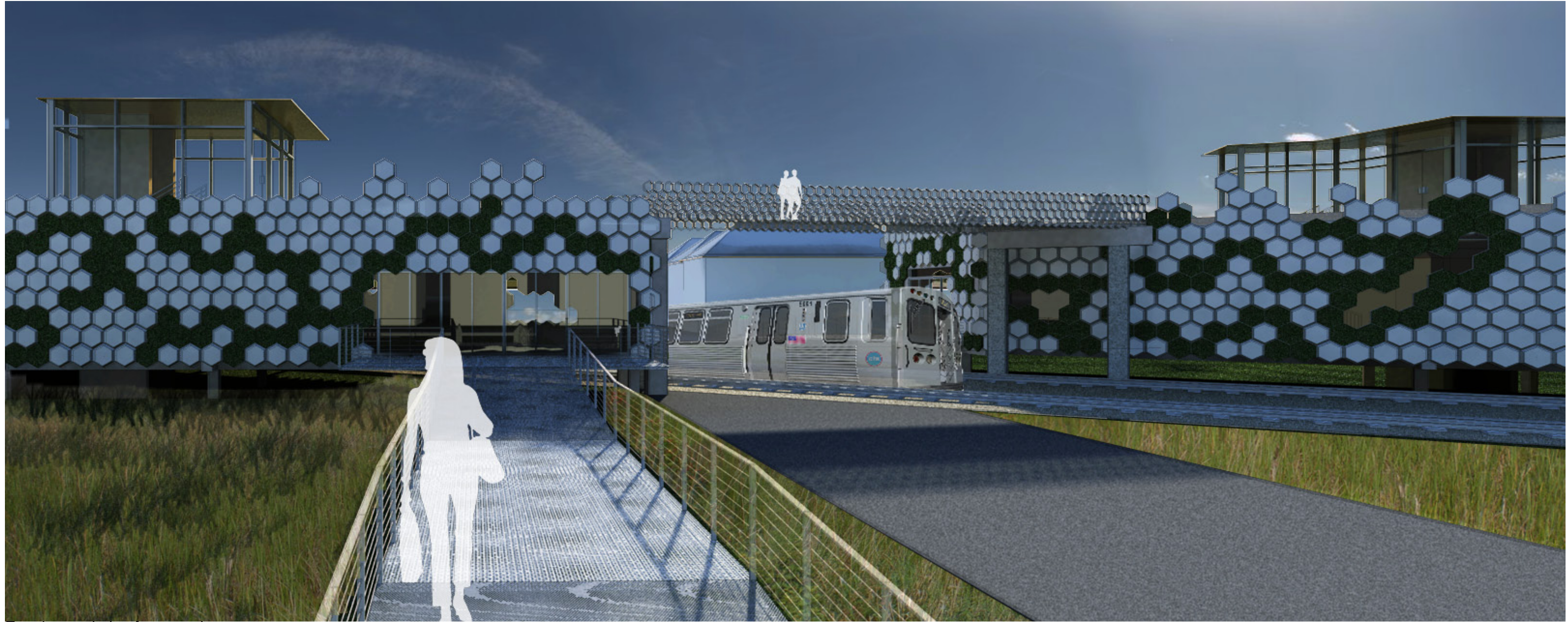
floor plan

east building



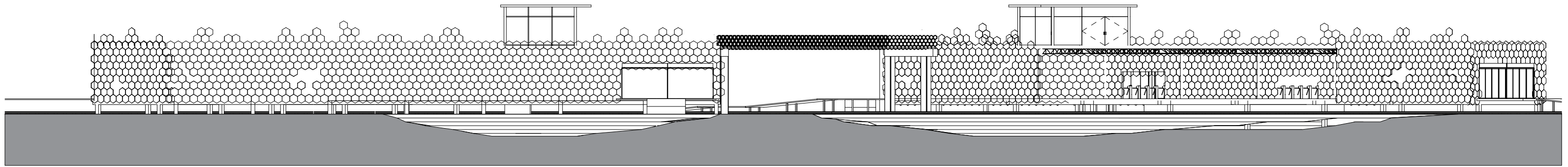
10' 25' 50'

10' 25' 50'

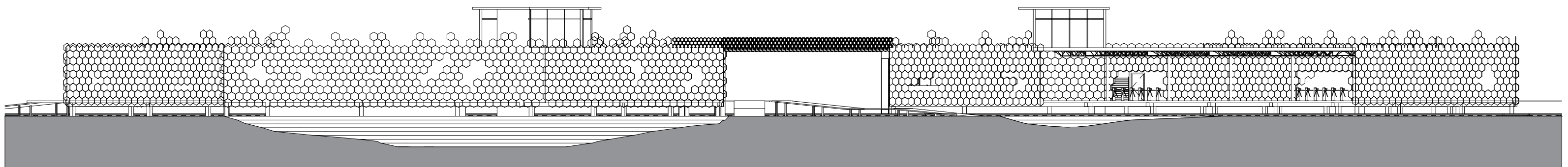


Exterior rendering from southeast entrance.

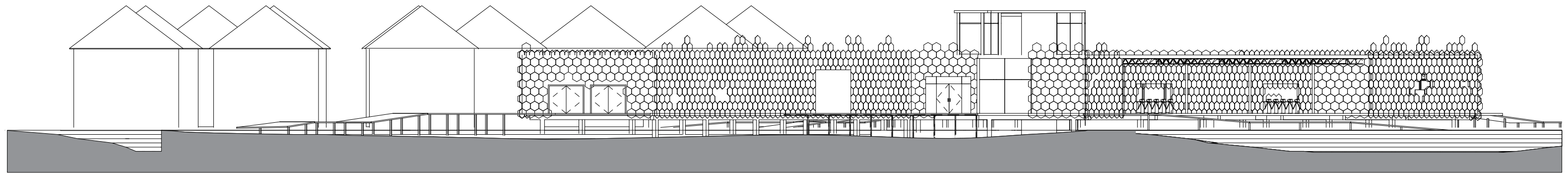
elevations



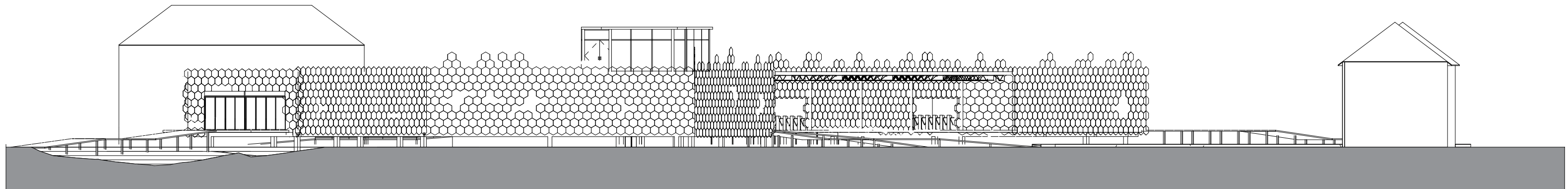
north elevation



south elevation



west elevation



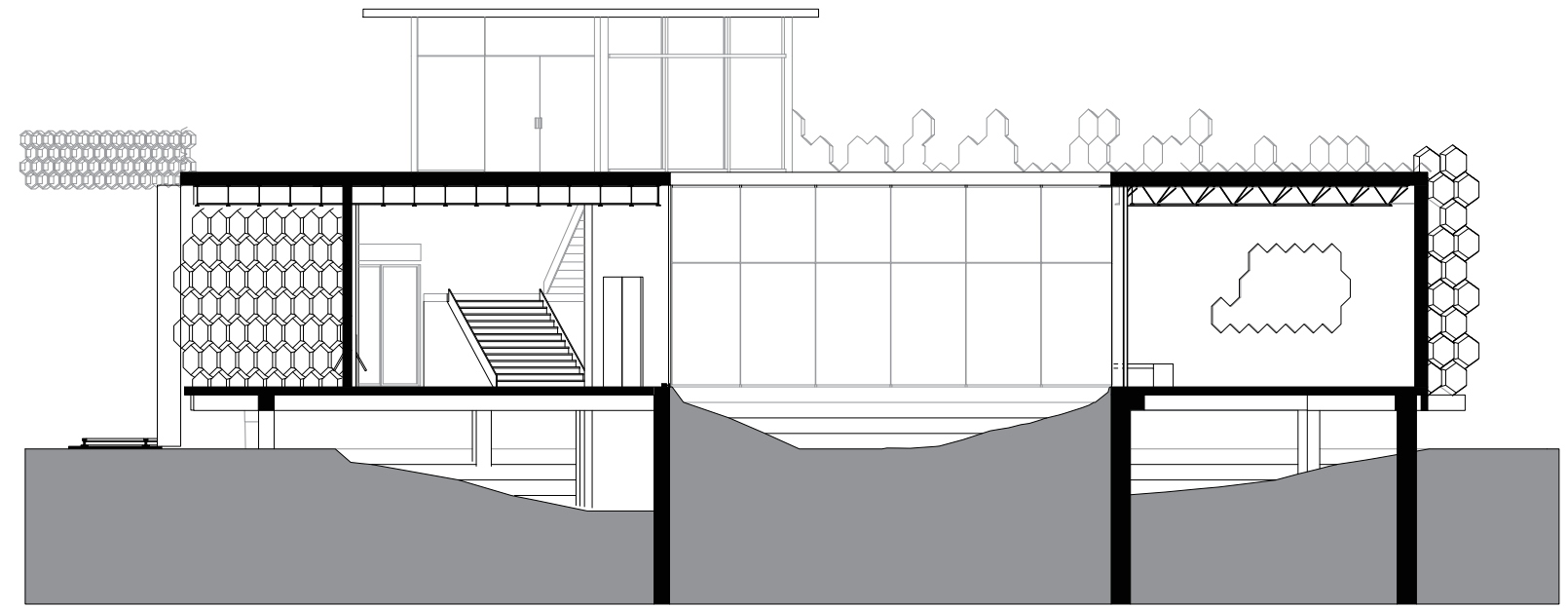
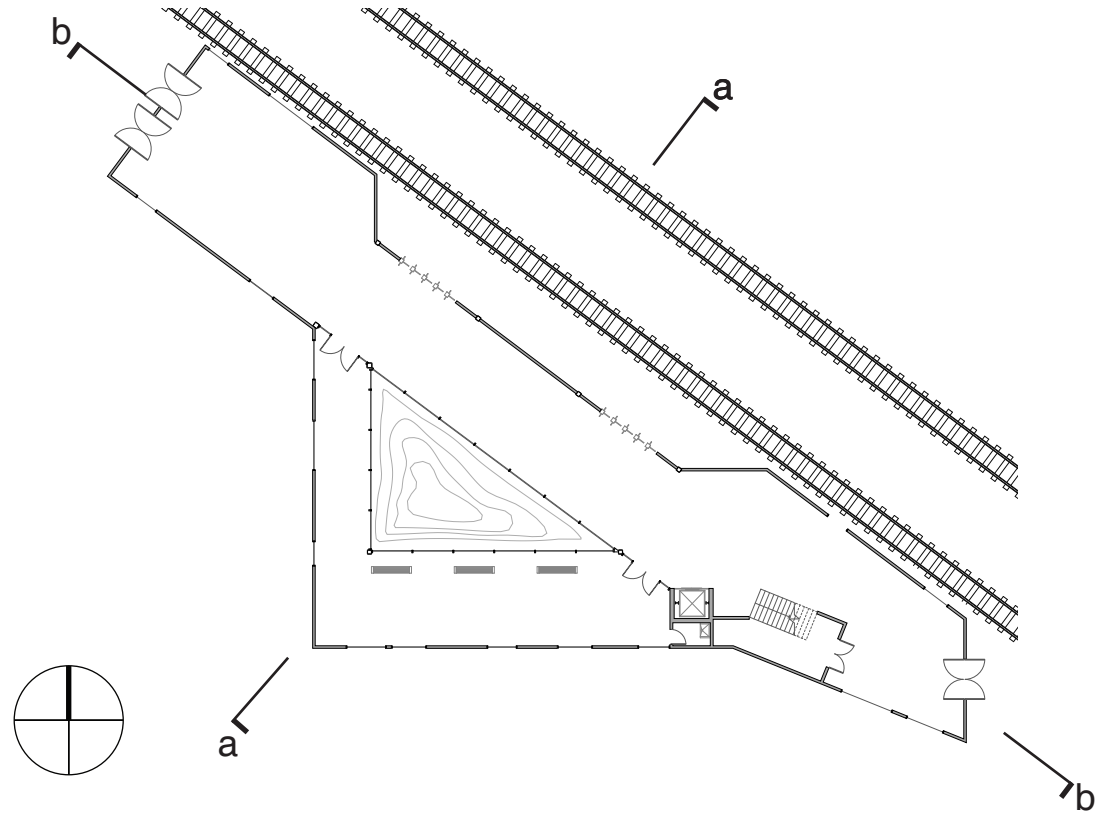
east elevation



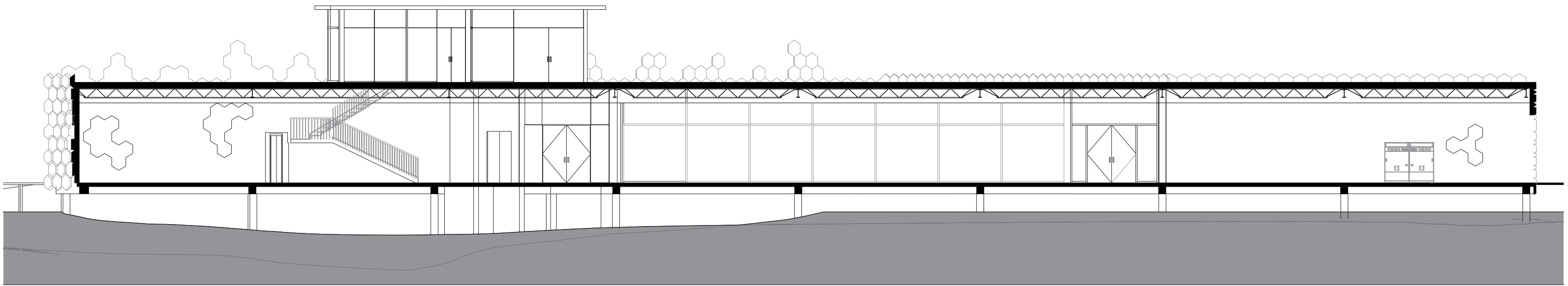
Interior rendering of cafe and outside observation area in east building.

sections + details

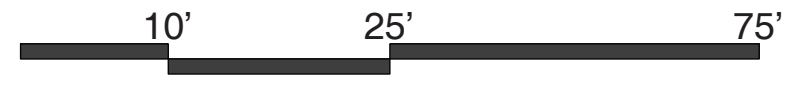
building sections



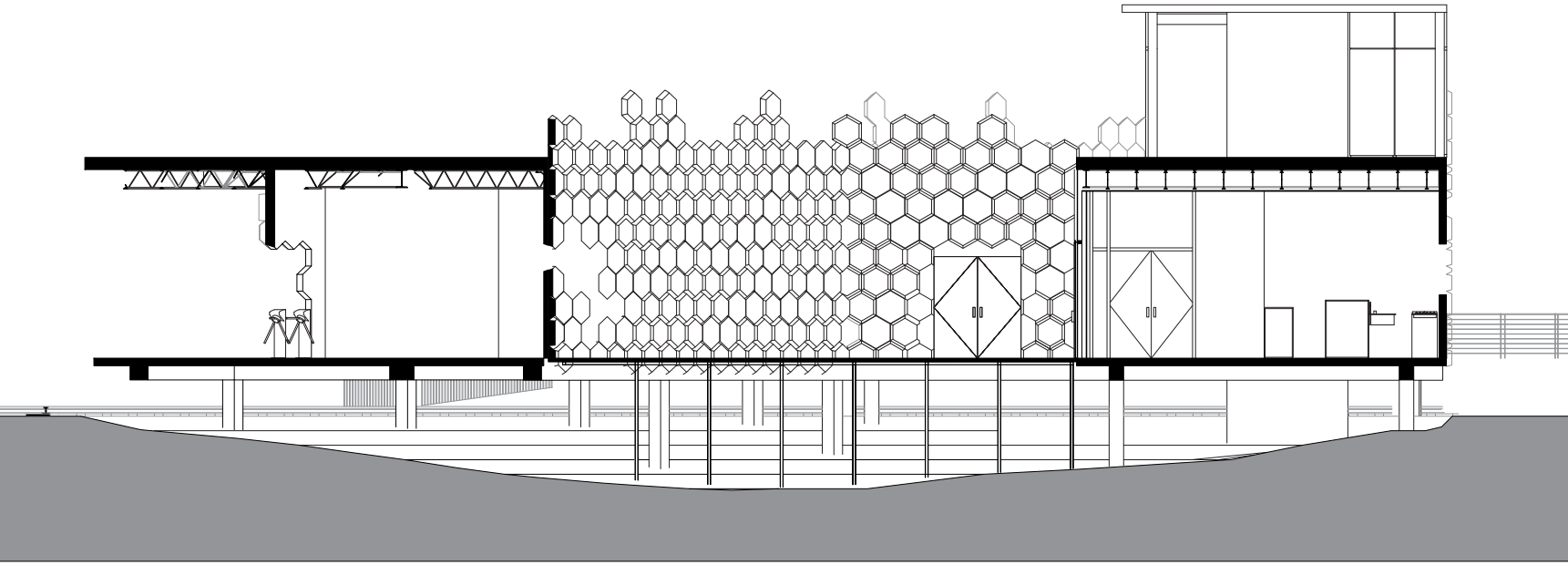
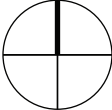
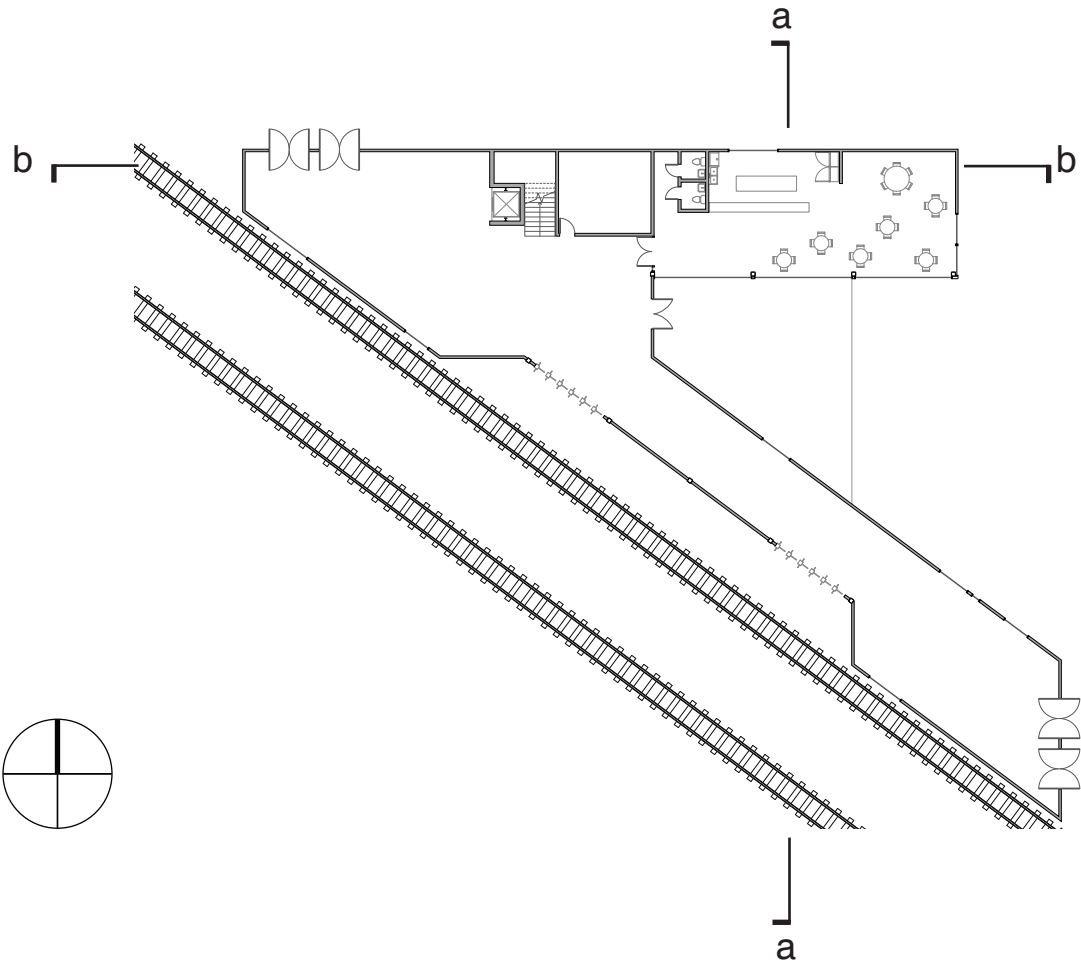
section aa - west building



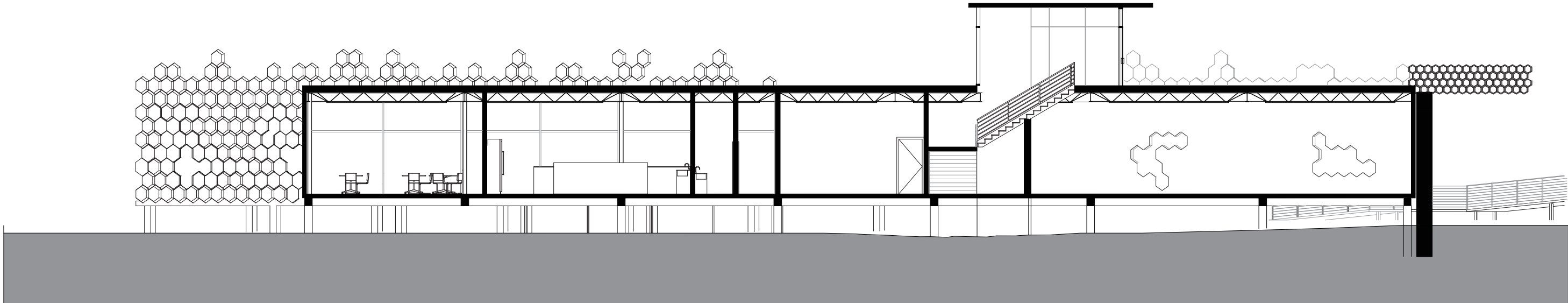
section bb - west building



building sections



section aa - east building

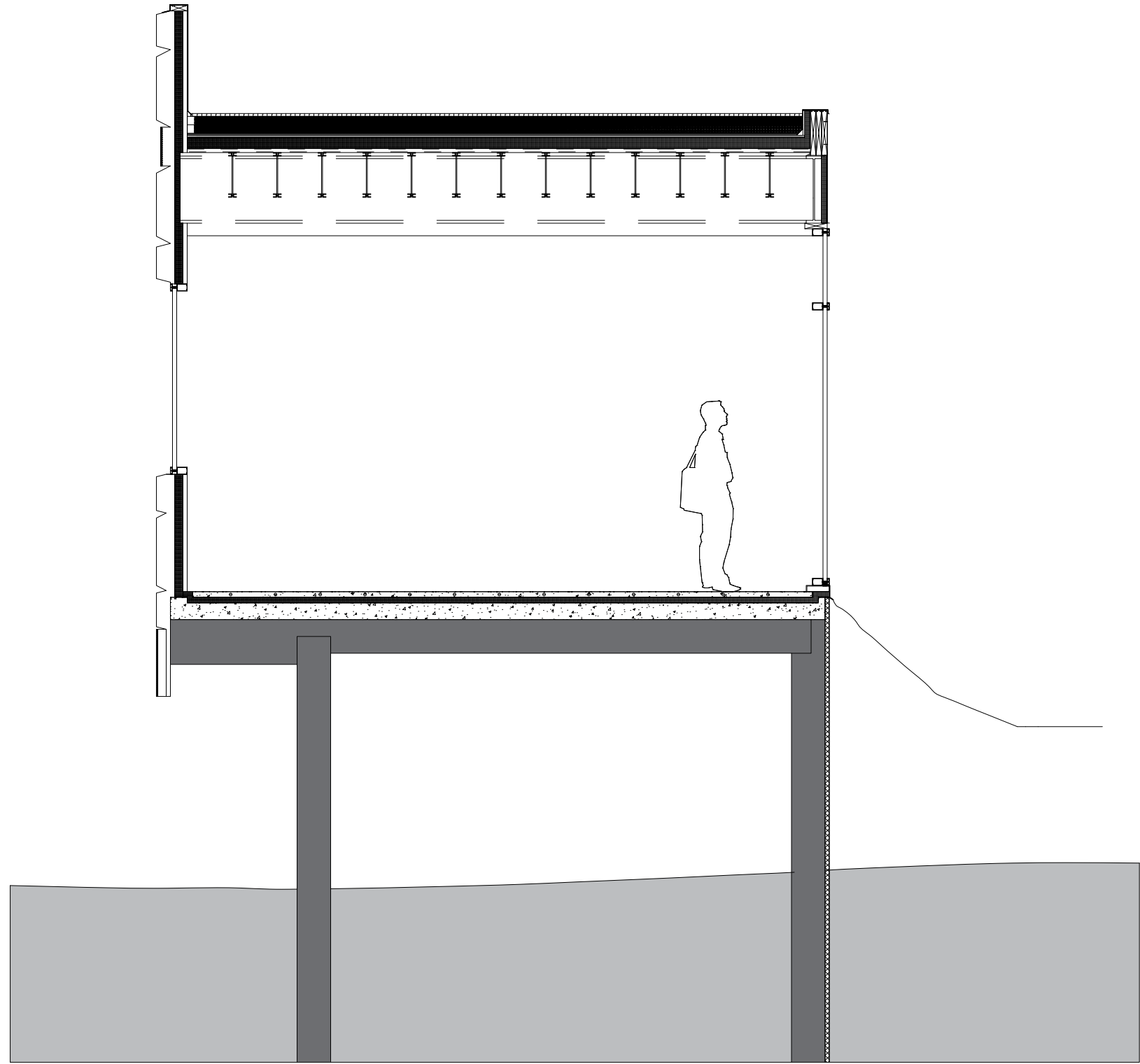


section bb - east building

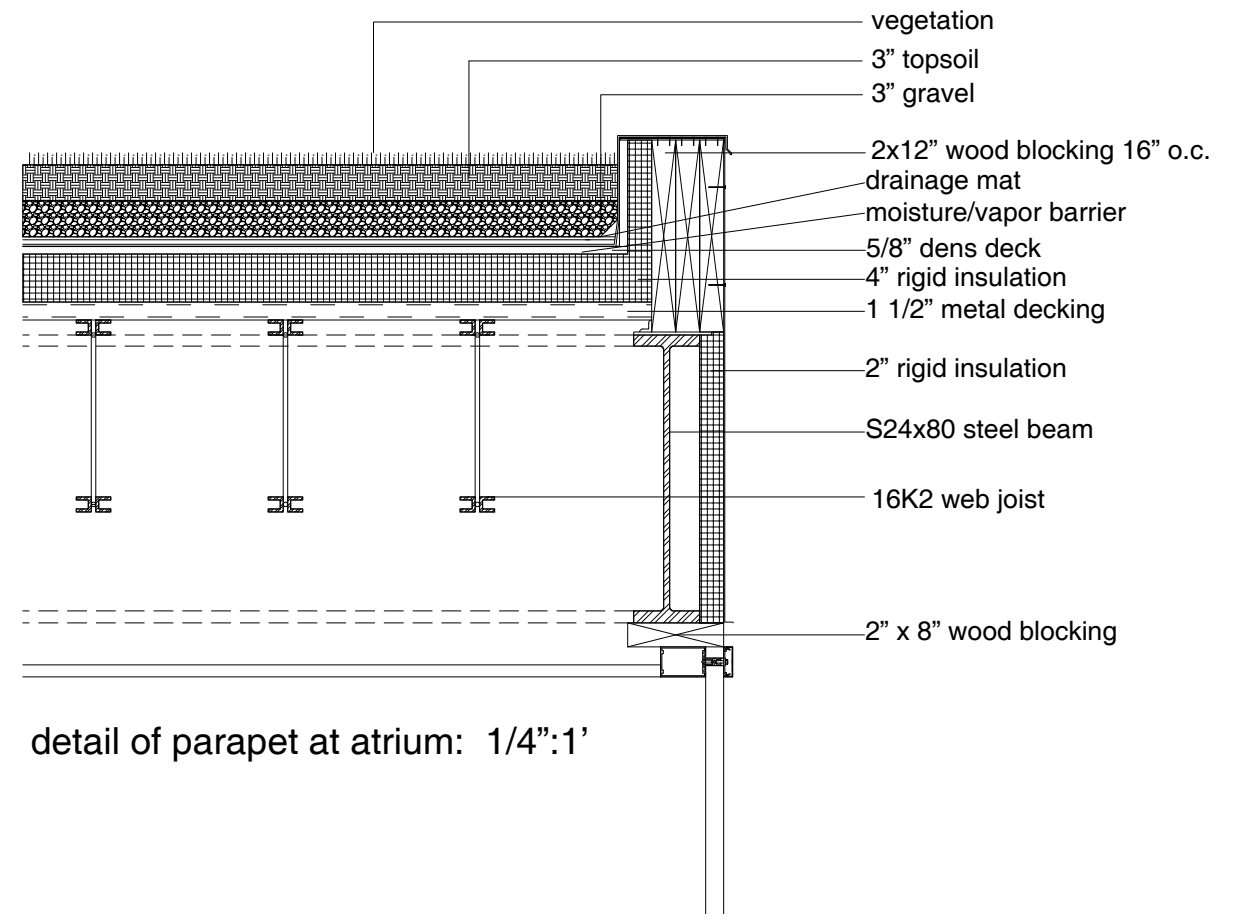




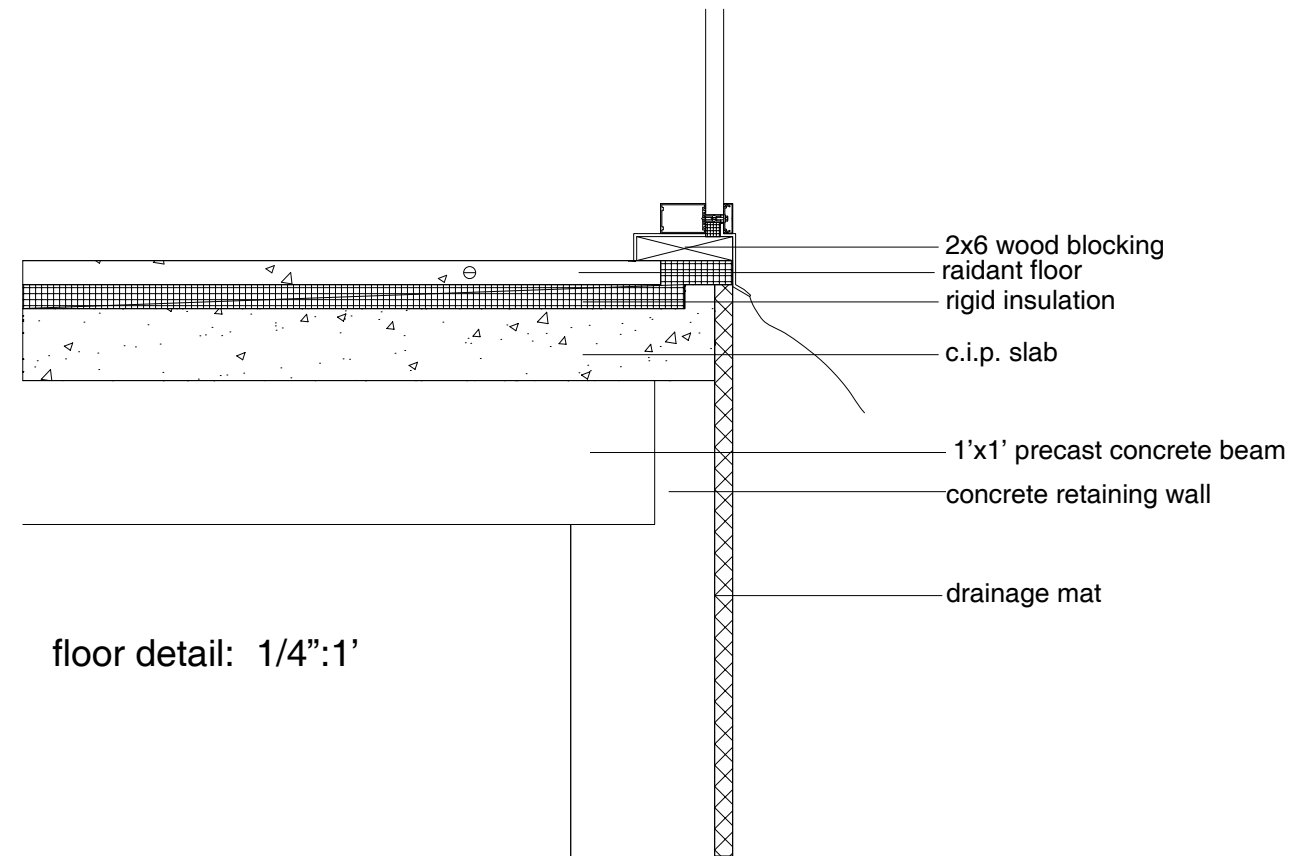
Interior rendering of exhibition space.



wall section - 1/8":1'



detail of parapet at atrium: 1/4":1'



floor detail: 1/4":1'

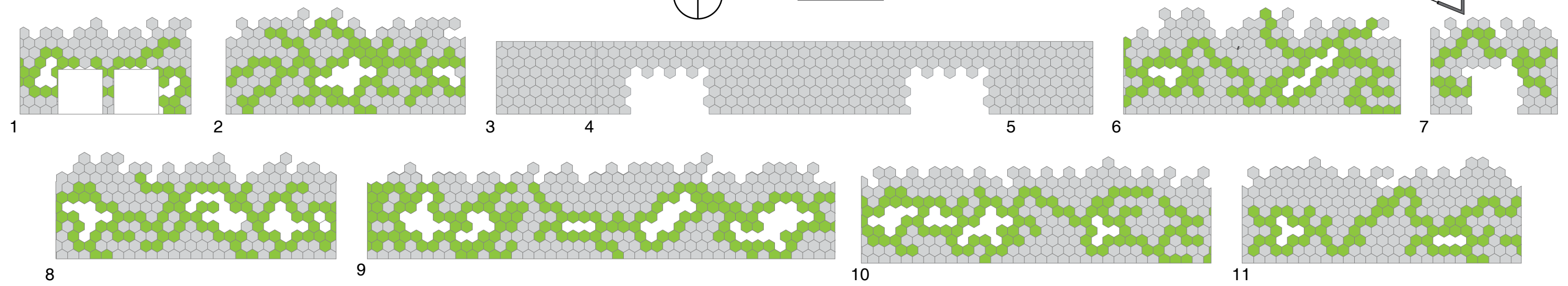
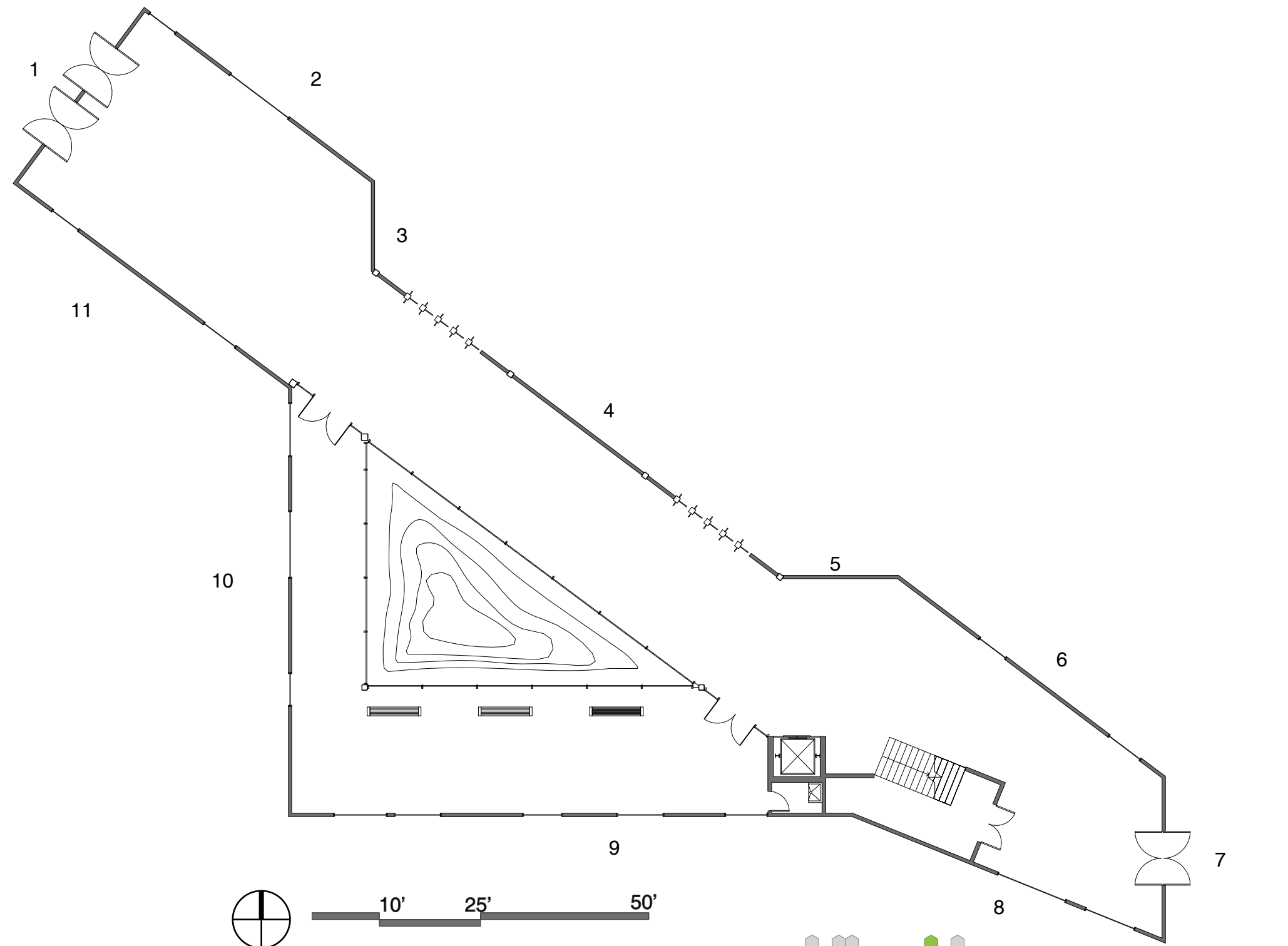
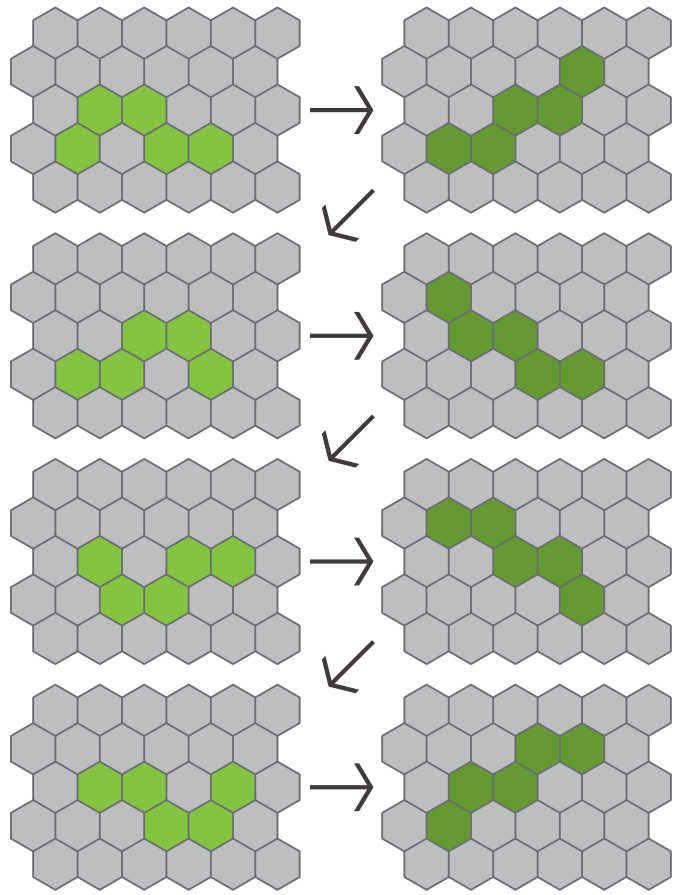


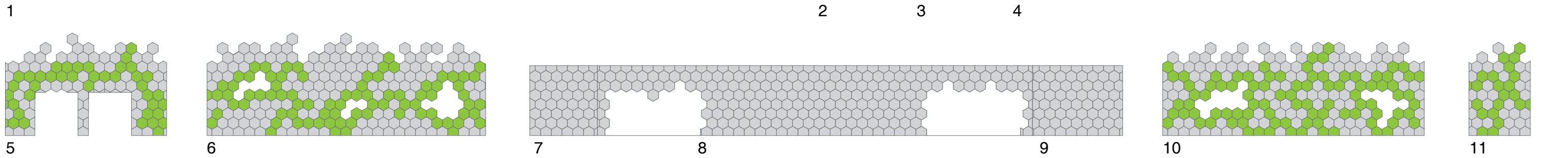
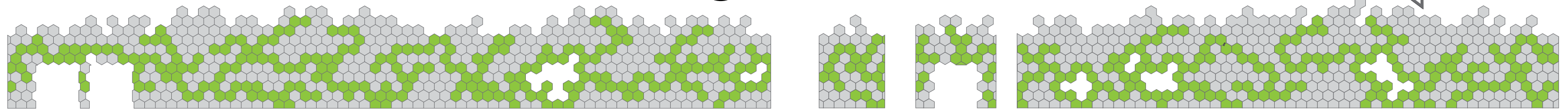
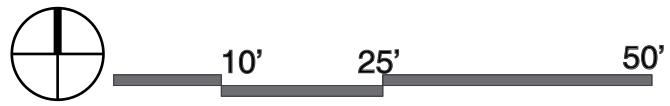
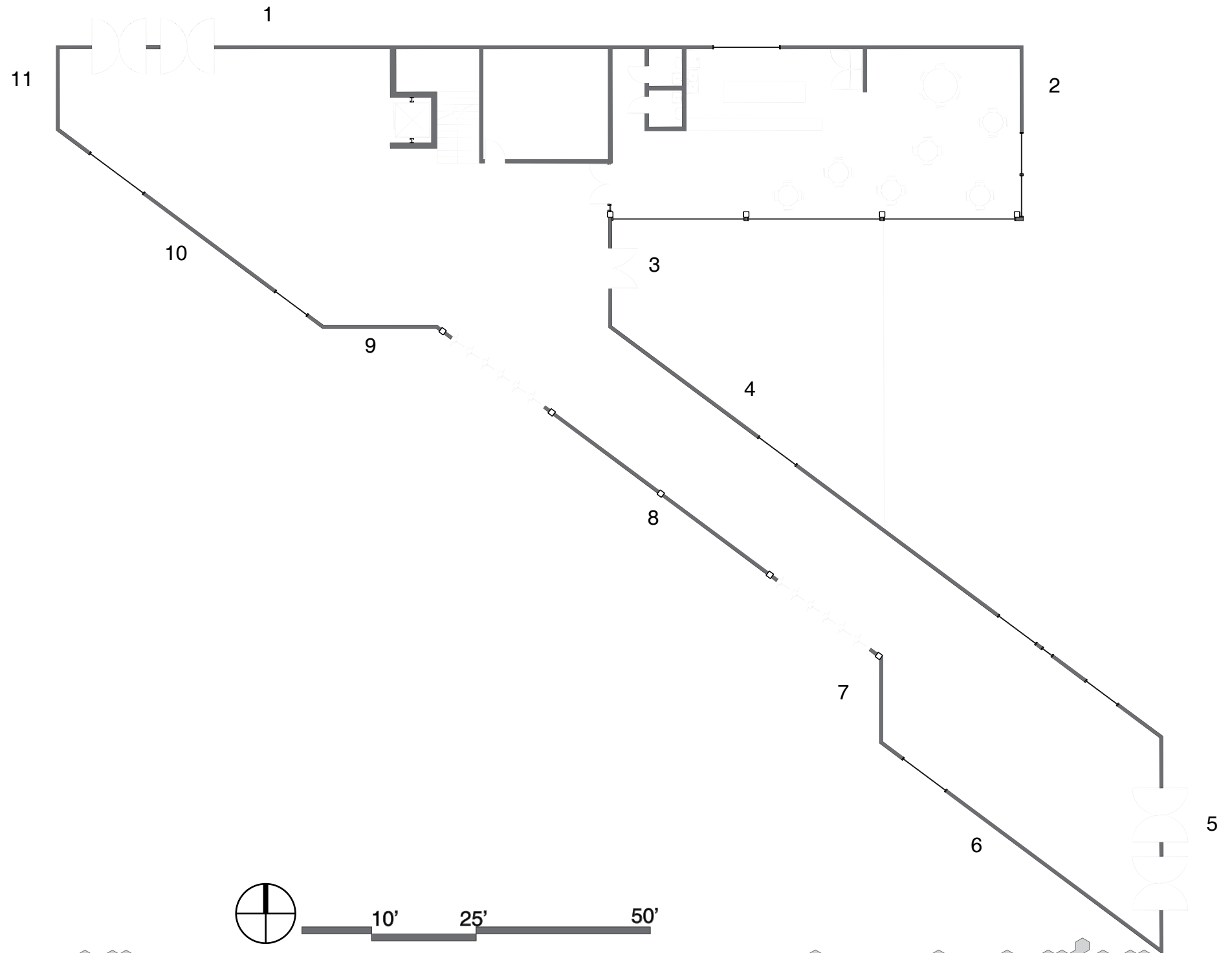
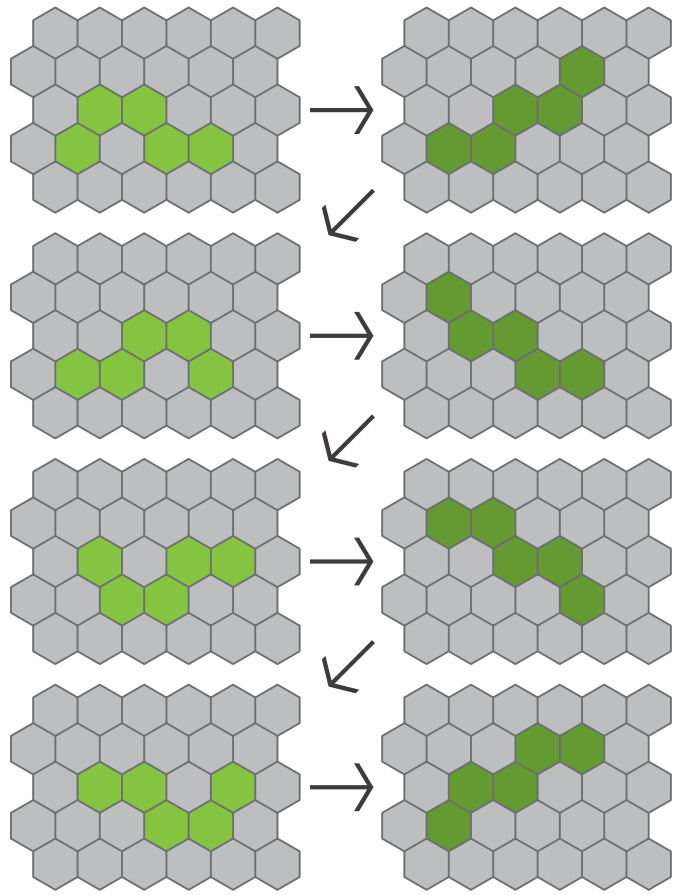
Exterior rendering from northwest entrance.

self-organizing system

The notion to employ a self organizing system was derived from two sources. The first being nature itself and, the second, the geometry of a permeable paving material. These two elements led to the development of a rule set that dictated which panels would be planted with sedum and where fenestration was located. The rule set was defined by two geometric patterns that were mirrored and rotated to create 6 other geometries. Then by following the rule set led certain panels to be completely encompassed by sedum. These areas that were surrounded by sedum panels determined where the fenestration in the building would occur. The self-organizing system of each building can be seen on the following pages as the sedum wraps from panel to panel to form a cohesive facade.

self organizing system



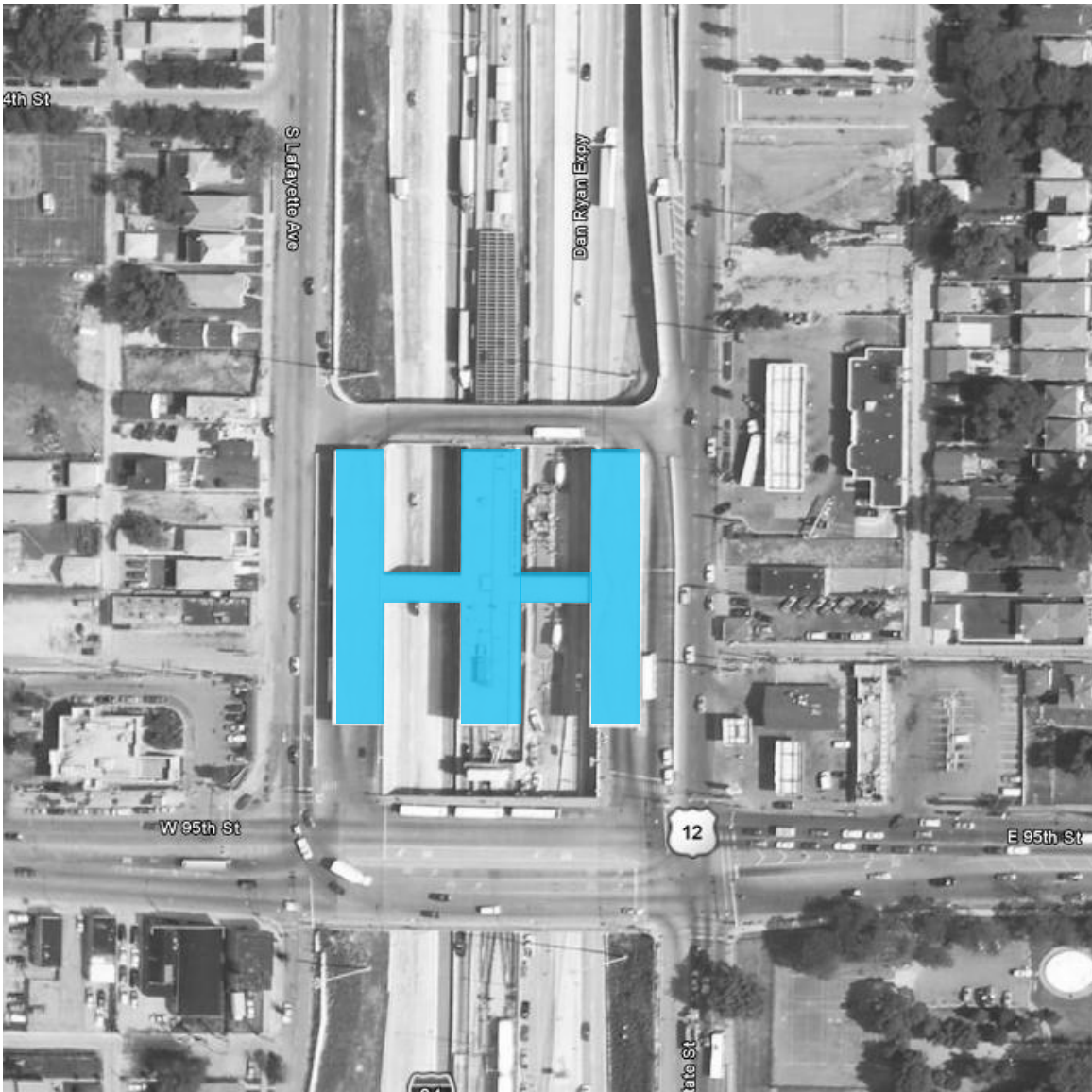


case studies

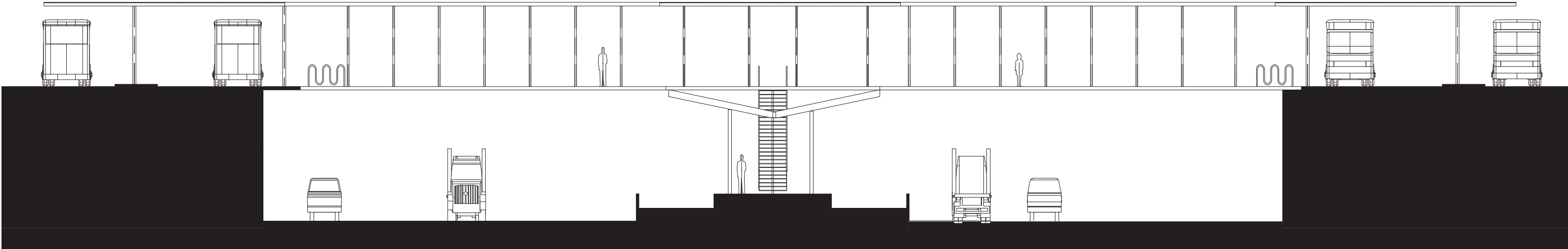
space programing study

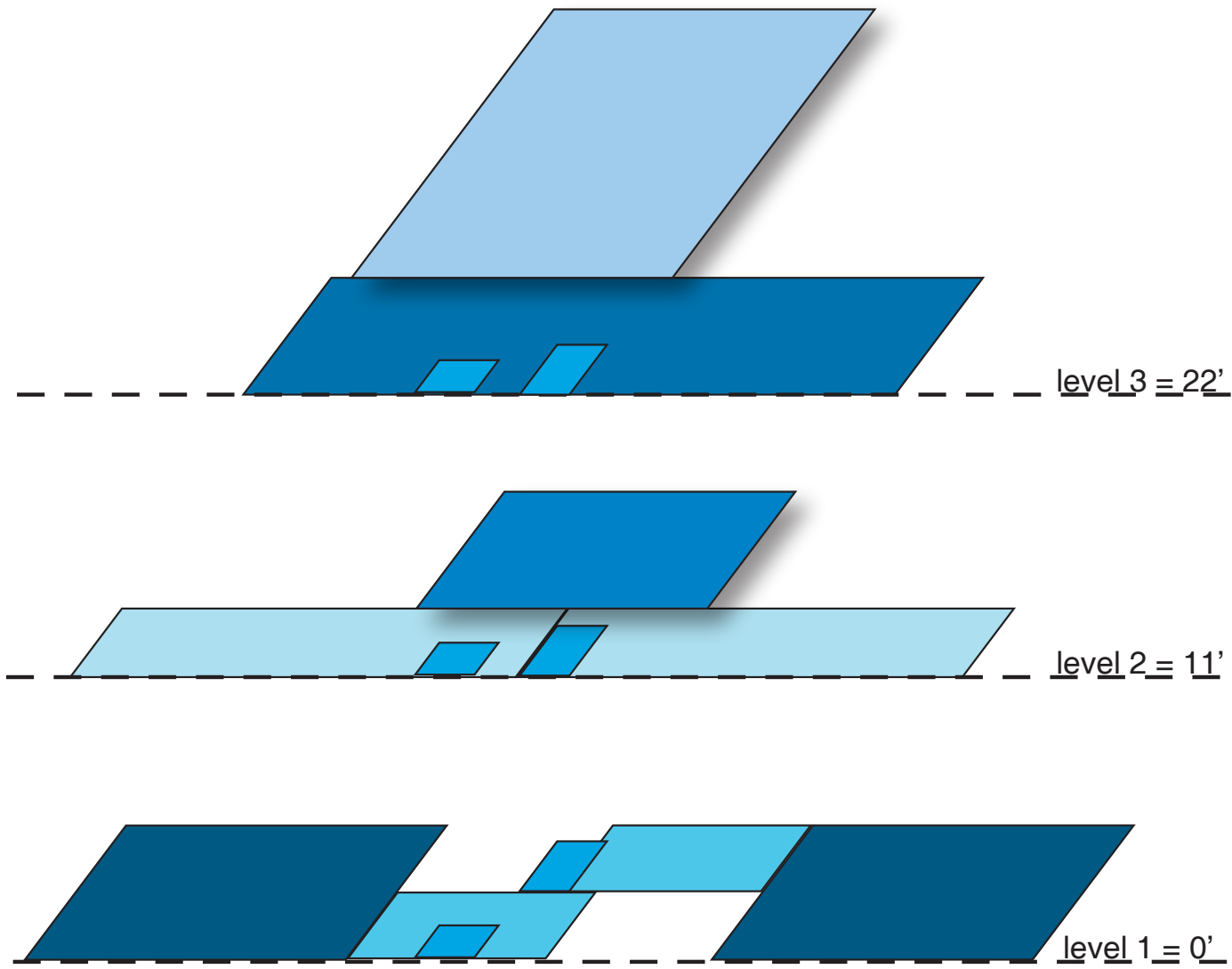
95th street intermodal node

The purpose of this study is to examine the spatial relationships and proportions allotted to the various programatic elements of an intermodal node of public transportation. The 95th street terminal was chosen due to the amount of users and expected amount of users at the various extension shops. Furthermore, this examination will enable the design qualities that can be built upon and those that should be avoided. This study also will demonstrate the circulation patterns for different users and how that circulation can be improved upon to cater to a wider variety of users.



416'





The 95th street analysis identified several interesting issues regarding circulation and access. First, by separating the various transportation terminals on different levels enables the CTA to have more control of its passengers in terms of ticketing and security. However, separating these terminals from one another makes it very difficult for certain users to gain access to the red line from the bus and vice versa; such as bicyclists, people with disabilities, elderly people, and mother's with strollers. In addition, this separation allows the program to only serve one function as it exerceices a lot of users during peak rush hours and not as much during the rest of the day. This project aims to enable everyone easy access to these intermodal nodes as well as increase use by integrating several programatic elements into these nodes.

bus terminals = 31%

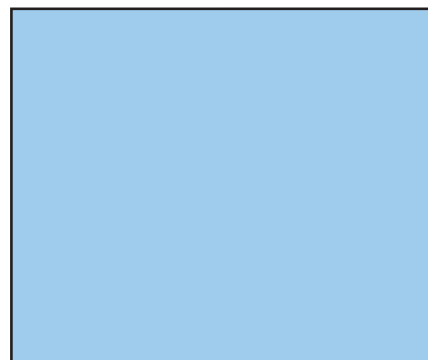
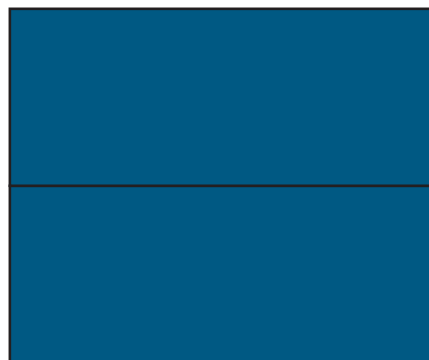
waiting platform = 34%

bike circulation = 16%

pedestrian circulation = 7%

vertical circulation = 2%

offices = 10%



plant conservation science center

location:
Chicago Botanic Garden, Highland Park, IL

size: 35,000 sf

date:
2008

client:
Chicago Botanic Garden

architect:
Booth Hansen Architects

The Chicago Botanic Garden's required new facilities to expand their research programs that fit within the Garden's existing master plan and existing aesthetic. There is a diverse program within this research facility that includes nine laboratories, seminar rooms, an expanded herbarium, a plant science library, a seed bank and office spaces. The building is elevated above the wetlands below in order not to interfere with the natural ecology below.





spanish pavilion expo

location:
Japan

size: n/a

date:
2005

client:
Spain

architect:
Foregin Office Architects

This temporary pavilion was erected using irregular earthenware hexagons as the exterior wall. The interior space consists of an open pavilion containing media displays to project various images of Spain and how the country has changed. The hexagonal geometry of the exterior wall is ideal because it makes the wall self-supporting as well as structural.





wetlands walk

location:

Texas State University, San Marcos

size:

date:

2002

client:

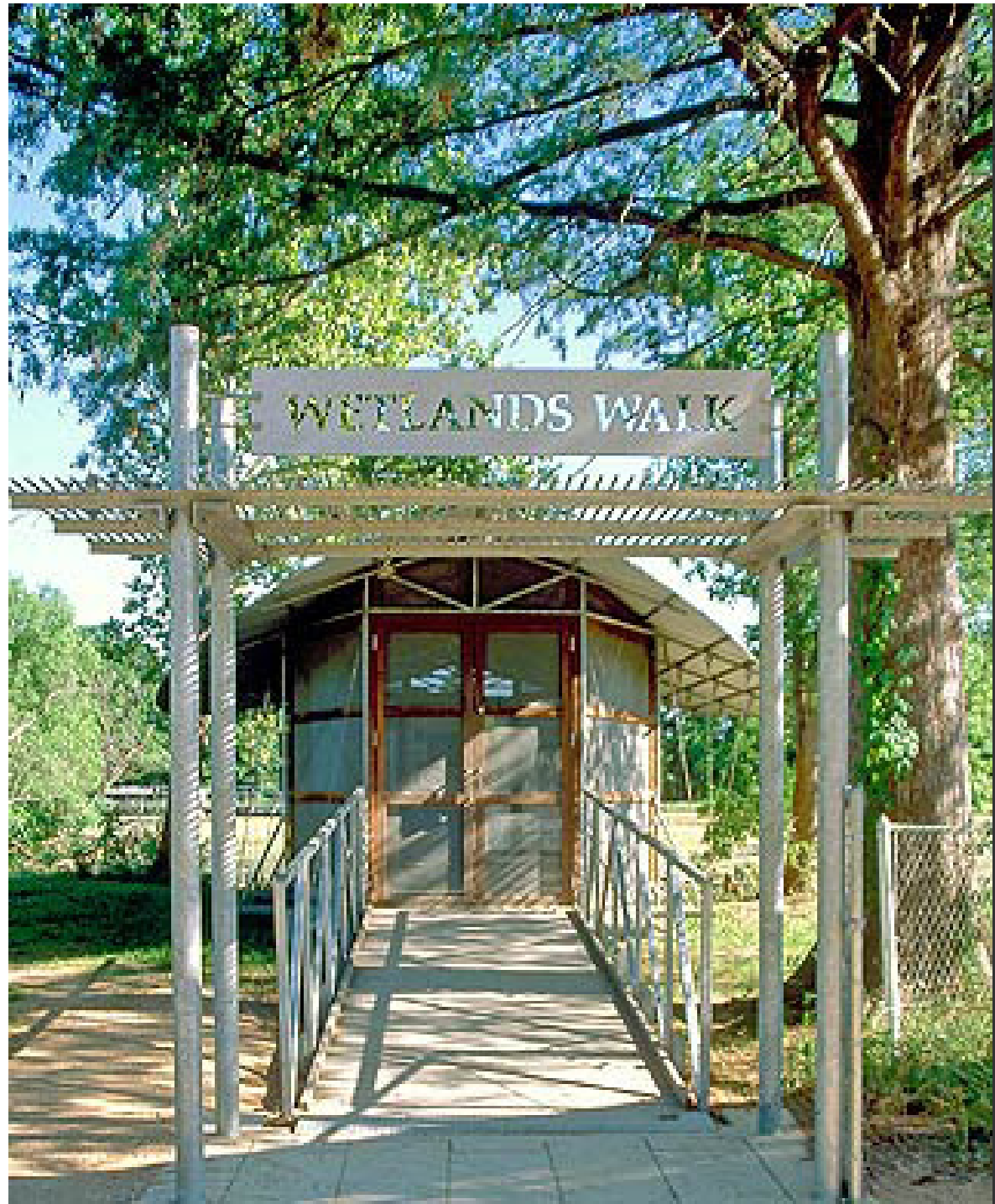
Texas State University

architect:

Lake|Flato Architects

Lake|Flato designed a self-guided interpretive boardwalk and visitor pavilion. The boardwalk traverses three wetland habitats: riparian woodland, emergent wetland, and open wetland. To protect the endangered species and their habitat, a unique deck flotation system was designed using recycled decking and a prefabricated galvanized steel boardwalk structure. Interpretive kiosks and signage at the entry pavilion and viewing periscopes allow visitors to explore the native wildlife.





lifescape - fresh kills parkland

location:
Fresh Kills, Staten Island, New York

size:
2,200 acres

date:
2005-2055

client:
New York City Department of City Planning

landscape architects:
Field Operations, James Corner

This project presents a long-term strategy to rehabilitate the Fresh Kills landfill on Staten Island based on natural processes, agricultural practice and plant life cycles. This 30 year strategy aims to transform what was once New York's largest landfill into a huge public park. This public park will consist of 2,200 acres of public park, 40 miles of trails and pathways, and significant recreational, cultural and educational amenities.



TODAY

mound-scape
engineering ground



3 YEARS

field-scape
manufacturing soil
and habitat



6 YEARS

open-scape
initiating access
and activity



10 YEARS

place-scape
building spaces



20 YEARS

event-scape
diversifying ecologies
and uses



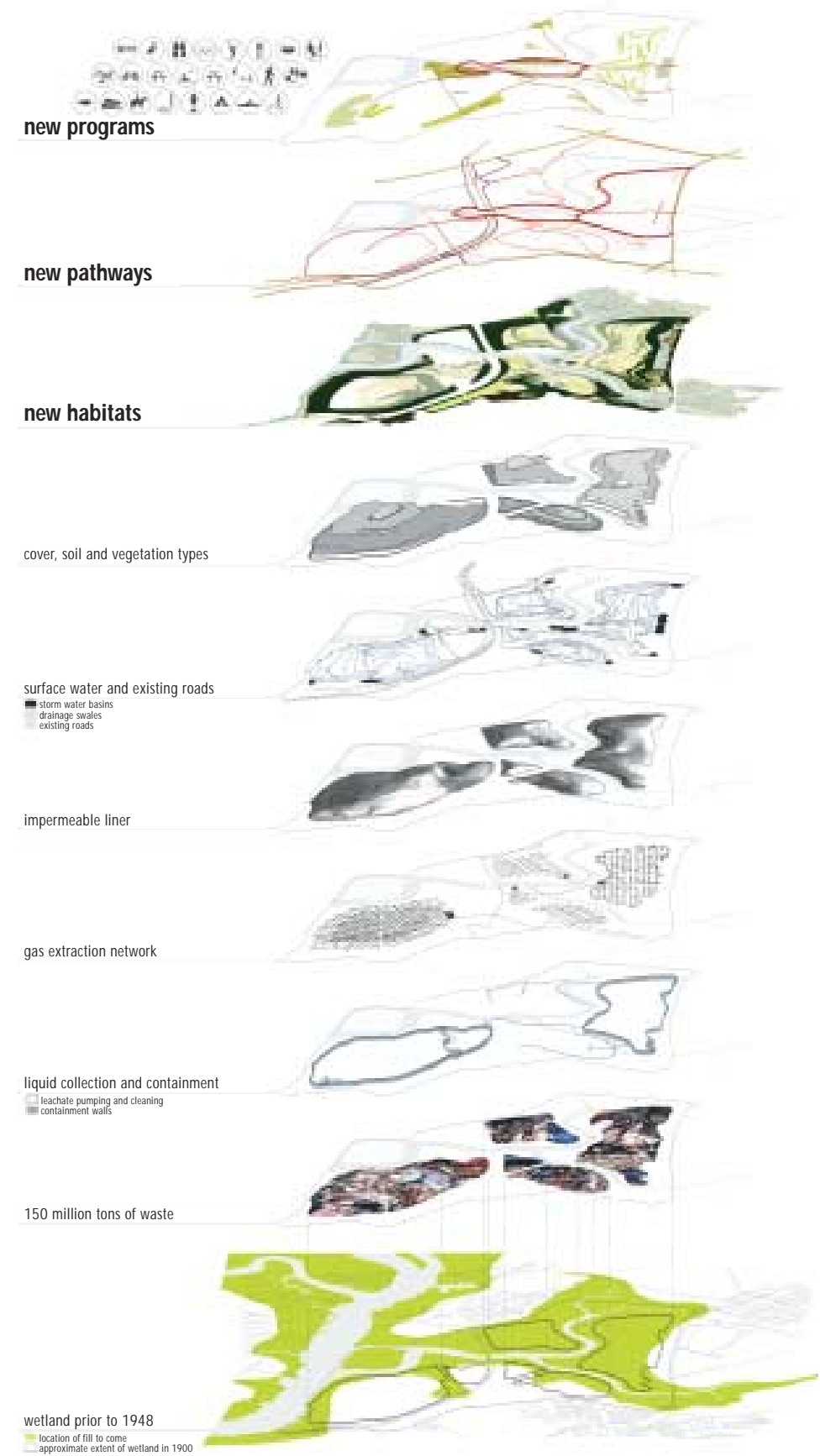
30 YEARS

lifescape
growing new life





LAYERS OF FRESH KILLS **lifescape**



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